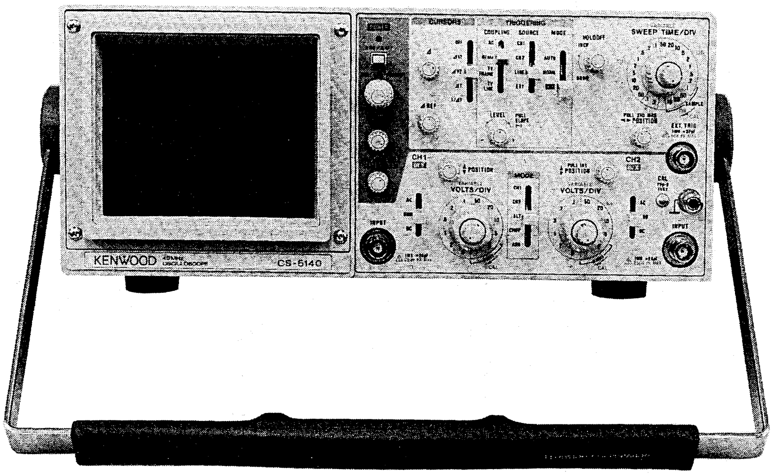
KENWOOD

40MHz DUAL TRACE OSCILLOSCOPE

CS-5140

SERVICE MANUAL

KENWOOD CORPORATION


KENWOOD
CS-5140
CURSORS
TRIGGERING
COUPLING
SOURCE
MODE
HOLDOFF
SWEEP TIME/DIV
LEVEL
POSITION
CH1
CH2
VOLTS/DIV
MODE
INPUT
EXT TRIG
CAL

WARNING

1. The following instructions are for use by qualified personnel only. To avoid electric shock, do not perform servicing other than contained in the operating instructions unless you are qualified to do so.

2. High voltage up to 12000 volts DC is present when the oscilloscope is operating. Line voltage (100 to 240 VAC) is present on the power transformer, on-off switch, fuse holder, and line voltage selector, any time the oscilloscope is connected to an AC power source, even if turned off. Always observe caution whether the AC plug is removed from the AC power source. Contacting exposed high voltage could result in fatal electric shock.

CONTENTS

SPECIFICATIONS 3
SAFETY 6
CIRCUIT DESCRIPTION 7
BLOCK DIAGRAM 13
ADJUSTMENT 14
TROUBLESHOOTING 23
PARTS LIST 33
SCHEMATIC DIAGRAM 47
P.C. BOARD 53
DISASSEMBLY 59
SEMICONDUCTORS 60

SPECIFICATIONS

CRT		
Model		150VTM31
Type		150 mm rectangular, with internal graticule
Acceleration Voltage		12 kV
Display Area		8 × 10 div (1 div = 10 mm)
VERTICAL AXIS (CH1 and CH2)		
Sensitivity		1 mV/div to 5 V/div, ±3%
Attenuator		12 steps, 1 mV/div to 5 V/div in 1-2-5 sequence Vernier control for fully adjustable sensitivity between steps
Input Impedance		1 MΩ ±2% approx. 24 pF
Frequency Response	DC	REAL TIME: DC to 40 MHz, −3 dB (5 mV to 5 V/div) DC to 5 MHz, −3 dB (1 mV, 2 mV/div) EQUIVALENT SAMPLING: DC to 100 MHz, −3 dB (5 mV to 5 V/div) DC to 5 MHz, −3 dB (1 mV, 2 mV/div)
	AC	REAL TIME: 5 Hz to 40 MHz, −3 dB (5 mV to 5 V/div) 5 Hz to 5 MHz, −3 dB (1 mV, 2 mV/div) EQUIVALENT SAMPLING: 5 Hz to 100 MHz, −3 dB (5 mV to 5 V/div) 5 Hz to 5 MHz, −3 dB (1 mV, 2 mV/div)
Rise Time		REAL TIME: 8.8 nsec or less (40 MHz, −3 dB) 70 nsec or less (5 MHz, −3 dB) EQUIVALENT SAMPLING: 3.5 nsec or less (100 MHz, −3 dB) 70 nsec or less (5 MHz, −3 dB)
Crosstalk		−40 dB or less
Operating Modes	CH1	CH1 single trace
	CH2	CH2 single trace
	ALT	Two-waveforms display, alternately
	CHOP	Two-waveforms display, chopped
	ADD (CH1+CH2)	CH1 + CH2 added display
CHOP Frequency		Approx. 250 kHz
Channel Polarity		Normal or inverted, channel 2 only inverted
Maximum Input Voltage		500 Vp-p or 250 V (DC+AC peak)
HORIZONTAL AXIS		Input thru CH2, ×10 MAG not included
Operating Modes		With TRIG MODE switch, X-Y operation is selectable (REAL TIME). CH1 ; Y axis CH2 ; X axis
Sensitivity		Same as vertical axis (CH2)
Input Impedance		Same as vertical axis (CH2)
Frequency Response	DC	DC to 500 kHz, −3 dB
	AC	5 Hz to 500 kHz, −3 dB
X-Y Phase Difference		3° or less at 50 kHz
Maximum Input Voltage		Same as vertical axis (CH2)

SPECIFICATIONS

SWEEP		
Sweep System	NORM	Triggering sweep
	AUTO	Sweep free runs in absence of trigger
Sweep Time		0.2 s/div to 10 ns/div, ±3%, in 23 ranges, in 1-2-5 sequence Vernier control provides fully adjustable sweep time between steps. REAL TIME: 0.2s~0.2 μs/div EQUIVALENT SAMPLING: 0.1 μs~10 ns/div
Sweep Magnification		×10 (ten times) ±5%
Linearity		±3% (0.2 μs~10 ns/div at ×10 MAG, ±5%)
HOLD OFF		Adjustable by the controller
TRIGGERING		
Internal Sync	CH1	Triggered by CH1 input signal
	CH2	Triggered by CH2 input signal
	LINE	Triggered by line frequency
External Sync	EXT	Triggered by signal applied to EXT TRIG INPUT jack
External Sync Input Impedance		Approx. 1 MΩ, approx. 32 pF
Max. External Trigger Voltage		50 V (DC+AC peak)
Coupling		AC, HFREJ, TV FRAME, TV LINE
Sync sensitivity	At NORM position	
	AC	REAL TIME: Sync frequency range : 10 Hz~50 MHz INT : 1 div, EXT : 0.1 Vp-p EQUIVALENT SAMPLING: Sync frequency range : 10 Hz~100 MHz INT : 1.5 div, EXT : 0.2 Vp-p
	HFREJ	When the sync frequency is more than 10 kHz, the minimum amplitude (voltage) required for sync is increased.
	TV	FRAME, LINE INT : 1.5 div, EXT : 0.15 Vp-p
	AUTO: Rating shown above is provided at 50 Hz or over.	
CALIBRATION VOLTAGE		1 V ±3%, square wave, positive polarity, 1 kHz ±3%
INTENSITY MODULATION		
Sensitivity		+5 V, positive voltage decreases brightness.
Input Impedance		Approx. 10 kΩ
Usable Frequency Range		DC to 2 MHz
Maximum Input Voltage		50 V (DC+AC peak)
READOUT		
Calendar		Year/Month/Day/O'clock/Minute Clock accuracy : ±2 min./month Battery life : About 20,000 hours (at room temperature)
Set value		CH1/CH2 scale factor (with probe detection), V-UNCAL, ADD, INVERT Sweep scale factor (magnification conversion), SWEEP VARIABLE-UNCAL, X-Y

SPECIFICATIONS

Cursor mode:	ΔV1:	Voltage difference between ΔREF and Δ cursors on the basis of CH1 scale factor
	ΔV2:	Voltage difference between ΔREF and Δ cursors on the basis of CH2 scale factor
	ΔT:	Time difference between ΔREF and Δ cursors on the basis of sweep scale factor
	1/ΔT:	Frequency between ΔREF and Δ cursors on the basis of sweep scale factor
	RATIO:	Voltage ratio and time ratio between ΔREF and Δ cursors, supposing 5 div on the CRT as 100%
	PHASE:	Phase difference between ΔREF and Δ cursors, supposing 5 div on the CRT as 360°
	NOTE: The X-Y mode allows ΔV1 measurement only.	
Cursor measurement	Resolution	10 bits
	Measurement accuracy	±4 %
	Measurable range	ΔV, RATIO: ±3.6 div or more from the CRT center ΔT, 1/ΔT, RATIO, PHASE: ±4.6 div or more from the CRT center
TRACE ROTATION (Electrical, adjustable from front panel)		
POWER REQUIREMENT		
Line Voltage		100 V/120 V/220 V/240 V AC ±10%
Line Frequency		50/60 Hz
Power Consumption		Approx. 53 W
DIMENSIONS (W×H×D)		319 (341)×132 (145)×380 (442) mm ( ) dimensions include protrusion from basic outline dimensions
WEIGHT		Approx. 9.5 kg
ENVIRONMENT		
Within Specifications		10°C to 35°C, 85% max. relative humidity
Full Operation		0°C to 40°C, 85% max. relative humidity
ACCESSORIES SUPPLIED		
Probe		PC-31 (READOUT compatible probe)×2 Attenuation: 1/10 Input Impedance: 10 MΩ 16 pF or less
Replacement Fuse		1.2A×2, 0.8A×2
Instruction Manual		1

* Circuit and rating are subject to change without notice due to developments in technology.

SAFETY

Before connecting the instrument to a power source, carefully read the following information, then verify that the proper power cord is used and the proper line fuse is installed for power source. The specified voltage is shown at the cover of the fuse holder on the rear panel. If the power cord is not applied for specified voltage, there is always a certain amount of danger from electric shock.

Line voltage

This instrument operates using AC power input voltages that 100/120/220/240 V at frequencies from 50 Hz to 60 Hz.

Power cord

The ground wire of the 3-wire AC power plug places the chassis and housing of the oscilloscope at earth ground. Do not attempt to defeat the ground wire connection or float the oscilloscope; to do so may pose a great safety hazard. The appropriate power cord is supplied by an option that is specified when the instrument is ordered.
The optional power cords are shown as follows in Fig. 1.

Line fuse

The fuse holder is located on the rear panel and contains the line fuse. Verify that the proper fuse is installed by replacing the line fuse.

Voltage conversion

This oscilloscope may be operated from either a 100 V to 240 V, 50/60 Hz power source. Use the following procedure to change from 100 to 240 volt operation or vice versa.

1. Replace fuse F 1 with a fuse of appropriate value, 1.2 amp for 100 VAC to 120 VAC operation, 0.8 amp for 220 VAC to 240 VAC operation.
2. When performing the reinsertion of leadwire for the voltage conversion, the appropriate power cord should be used. (See Fig. 1.)

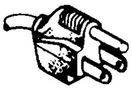
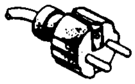
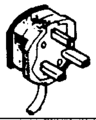
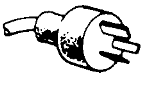
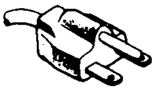
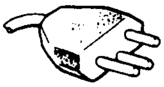
Plug configuration	Power cord and plug type	Factory installed instrument fuse	Line cord plug fuse	Parts No. for power cord and plate
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	1.2 A, 250 V Fast blow 6 x 30 mm	None	Cord: E30-1820-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	0.8 A, 250 V T. lag 5 x 20 mm	None	Cord: E30-1819-05
	U.K. 240 volt/50 Hz Rated 13 amp	0.8 A, 250 V Fast blow 6 x 30 mm	0.8 A Type C	–
	Australian 240 volt/50 Hz Rated 10 amp	0.8 A, 250 V Fast blow 6 x 30 mm	None	Cord: E30-1821-05
	North American 240 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.8 A, 250 V Fast blow 6 x 30 mm	None	–
	Switzerland 240 volt/50 Hz Rated 10 amp	0.8 A, 250 V Fast blow 6 x 30 mm	None	–

Fig. 1 Power Input Voltage Configuration

CIRCUIT DESCRIPTION

Vertical Attenuator Circuit (X73-1750-00)

The vertical attenuator rotary switch unit is a single unit comprising an attenuator circuit and range selection switch. The vertical input signal from the BNC input terminal is input to the initial stage attenuator circuit after selection of the input coupling method by the AC-GND-DC switch. The signal input to the initial stage circuit is switched to pass through either a 1/1, 1/10, or 1/100 attenuator by the vertical rotary switch, and is sent to the initial stage buffer amp.

The initial stage buffer amp is comprised of Q1, 2, 3, 4, 5, and U1 (CH2: Q101, 102, 103, 104, 105, and U101). The signal input to the initial stage buffer amp is separated into the high frequency components and low frequency components. The high and low frequency components are impedance converted by Q3 (Q103) and U1 (U101) respectively, synthesized by the base of Q5 (Q105), and output from the emitter. U1 (U101) is an OP amp with low DC offset drift, and the output of Q5 (Q105) is stabilized in relation to temperature.

This output signal is input to the second stage attenuator, is attenuated to either 1/1, 1/2, 1/4, or 1/10, and is sent to the 2nd amp. Attenuated output with good frequency characteristics can be obtained as this second stage attenuator has low impedance. When the 1 mV or 2 mV/DIV range is selected, there is a switch for setting the 2nd amp to 5X amplification. Q4 (Q104) is a constant-current source for the Q3 (Q103) load. Q1, 2, and D1 (Q101, Q102, and D101) are components to protect the circuit from excessive input.

Adjusters: VR1 (VR101) is the step attenuator balance adjuster, and VR2 (VR102) is the low frequency gain adjuster.

Vertical Pre-amp Circuit (X73-1750-00)

The signals output from the attenuator circuit are sent to the 2nd amp formed from the Q6 and Q8 (Q106 and Q108) dual transistor. The 2nd amp is a gain selection-type amp and operates either Q6 or Q8 (Q106 or Q108) by switching the current source of Q9 and Q10 (Q109 and Q110). When a range other than 1 mV or 2 mV/DIV is set, Q9 (Q109) is selected and the Q6 (Q106) amp functions. When the 1 mV or 2 mV/DIV range is set, Q10 (Q110) is selected and the Q8 (Q108) amp functions to provide amplification 5X that of normal. TH1 (TH101) is connected to the emitter of Q8 (Q108) for gain drift compensation when the range is 1 mV or 2 mV/DIV. D4 and D5 (D104 and D105) are connected to the collector of Q8 (Q108) to improve isolation with Q6 (Q106). The variable terminal of the 2-gain variable resistor attached to the attenuator is connected to the output of the 2nd amp. The method of output from the other terminal of this VR to the next stage allows for a continuous variable attenuator with good frequency characteristics.

The 2nd amp output signal passes through the Q11 and Q12 (Q111 and Q112) emitter follower and is output to the 3rd amp formed by Q14 and Q15 (Q114 and Q115). In order to realize high CMRR in this stage, a constant-current source is used for the emitter load of the differential transistors. Also, in order to minimize the effect on the feedback capacity of the transistors at high frequencies, the output stage has a cascode amplifier construction with Q16 and 17 (Q116 to Q119) connected to the base ground. On the CH2 side, the collectors of Q117 and Q119, and Q118 and Q116 are connected and the base potential of Q117, Q118, and Q116, Q119 is switched by S104 to output signals with positive and negative polarity.

The 3rd amp output signal passes through the Q18 and Q19 (Q120 and Q121) emitter follower and is sent to the equivalent time sampling circuit and the real time mode circuit. Trigger signals are output from the emitters of Q18 and 19 (Q120 and 121) and are input the trig amp Q215 and 216 (Q217 and 218). On the CH2 side, a signal with the reverse polarity of the trigger signal is output as the X signal.

Adjusters: VR3 (VR103) is the MAG/NORM balance adjuster, VR4 (VR104) is the gain adjuster of the 1 mV/div range, VR5 (VR105) is the variable balance adjuster, VR108 is the CH2 INV balance adjuster, VR202 is the X gain adjuster, and VR8, TC1 and TC2 (VR9, TC101 and TC102) are the adjusters for compensation of frequency characteristics.

The signal input to the equivalent time sampling circuit first enters U501 (U601). U501a and U501b (U601a and U601b) form a circuit which limits operating point drift occurring when the dual polarity signal of the differential amp is converted to a single polarity signal for the single end circuit. The output of this circuit passes through transistor Q505 (Q605) for driving the delay line, and is input to the 50 Ω coaxial cable delay line. The signal delayed approximately 50 ns by the delay line passes through the Q506 (Q606) emitter follower, and is sampled and held by the sampling gate comprised by Q507, 508, and D506 to 511 (Q607, 608, and D606 to 611), according to the sampling pulse. The signal converted to low frequency by the equivalent time sampling circuit passes through the Q509 and 510 (Q609, 610) source follower, and enters the 4th amp Q513, 514, 203, and 204 (Q613, 614, 207, and 208).

Adjusters: VR501 (VR601) is the position adjuster for sampling, VR502 (VR602) is the gain adjuster for sampling, VR503 (VR603) is the 10 kHz square wave waveform adjuster for sampling, and TC501 (TC601) is the adjuster for frequency response compensation.

The signal input to the real mode circuit enters the 4th amp directly. The 4th amp is a cascode amplifier configured

CIRCUIT DESCRIPTION

from Q503, 504, 203, and 204 (Q603, 604, 207, and 208), and the collector circuit formed from Q503, 504, 513, and 514 (Q603, 604, 613, and 614) is equipped with a vertical position control.

Adjusters: VR504 is the position adjuster for the real mode, TC602 is the adjuster for CH2 frequency response compensation in the real mode, and VR605 is the CH2 gain adjuster for the real mode.

Switching between the equivalent sampling time circuit and real time mode circuit is performed by the circuit formed from Q511 and 512 (Q611 and 612).

The output sections of the amps (cascode amp) for the equivalent time sampling circuit and real time mode circuit use the same base grounded transistors Q203 and 204 (Q207 and 208).

The CH1 output terminals, collectors of Q203 and 204, are connected to the CH2 output terminals, collectors of Q207 and 208, and the emitters of Q203, 204, 207, and 208 are connected to the emitters of the transistors for channel selection, Q201, 202, 205, and 206, respectively.

The channel selection signals passes through Q201, Q202, Q205, and Q206, switch the output transistors Q203, Q204 and Q207, Q208 ON/OFF, and select the vertical mode. Also, Q209 is a transistor to reduce fluctuations in the operating point of the ADD mode and other modes.

Adjuster: VR605 is the CH2 gain adjuster.

The output of the 4th amp passes through the Q210 and 211 emitter follower and is input to the base of Q212 and 213. Q212 and 213 form a cascode amp together with the Q1, 2 of the final amp. Thus, the vertical pre-amp output signals are current output.

Adjusters: VR201 and TC201 are the adjusters for compensation of frequency characteristics.

Trigger Signal Selection Circuit (X73-1750-00)

The trigger signals output differentially from the various channels pass through the Q215 and 216 (Q217 and 218) trigger output amp and enter the trigger selection circuit formed by Q255 to 262.

The EXT trigger signal and signal for line trigger from the power supply circuit also enter this circuit.

The various trigger enable signals are input to the base of Q255 to Q258, and Q259 to Q262 are switched ON/OFF to select the trigger signal. The selected signal is sent to the sweep unit.

Vertical Final Amp (X80-1090-00)

The signal sent from the vertical pre-amp is amplified at the base ground stage of the Q1 and Q2 cascode amp, passes through the emitter follower of Q3 and Q4 and is sent to the next stage amp. Q5, 6, 7, and 8 also form a cascode amp. Thermistor TH1 for gain temperature drift compensation and R16, 17, C50, and 51 for ultra-low frequency compensation are located between the Q5 and 6 emitters. The output of this stage passes through the emitter followers of Q9 and 10, and is sent to the Q11, 13, 15, and 16 output amp for amplification to 2.5 V/div (one side).

VR1 is a variable resistor (VR) for gain adjustment and VR2 is a VR for CRT center adjustment. VR5 is a VR for adjustment of the operating point and the voltage of P37 is set to +37 V by adjustment of this adjuster.

The readout Y signal (Y R/O SIG signal) is input to Q17 and Q18. Switching between the REAL signal and Y R/O SIG signal is performed by switching Q19 and 20. D1 and 2 are included to improve isolation. The cursor gain is adjusted by VR3 and the cursor Y position is adjusted by VR4.

Adjusters: TC1 and TC2 are the adjusters for compensation of frequency characteristics.

Power Supply Circuit (X68-1480-00)

The power supply consists of a five-system regulated power supply, two-system non-regulated power supply, and scale illumination power supply system.

When the power switch is turned on, −10 V is first turned on by Q2, U1, and D8. The −10 V voltage is regulated based on D8. The other voltages of +10 V, +5 V, +65 V, and +120 V are regulated based upon −10 V.

The +10 V, +5 V, and −10 V power supplies use the collector output method in order to reduce power consumption, the +65 V and +120 V power supplies use the emitter output method as there is little current.

The scale illumination circuit is a circuit for illuminating the lamps by controlling the voltage rectified by D1 by Q8.

Trace Rotation and CAL Circuit (X68-1480-00)

The trace rotation circuit consists of the emitter followers of the Q17 and 18 complementary transistors, and is the circuit supplies current to the rotation coil positioned in the CRT cone section.

The CAL circuit is comprised of U2, D26, and D27. A 1 kHz square wave is created by the U2 multi-vibrator oscillation circuit and this is switched by D26 and 27 to create the 1 Vp-p CAL signal. The frequency is adjusted by VR5 and the level is adjusted by VR6.

CIRCUIT DESCRIPTION

Blanking Circuit and High Voltage Circuit (X68-1480-00)

The unblanking signal from P26 is inverted and amplified by the blanking amp formed by Q11 to Q13 and is overlapped with the cathode voltage by the DC regeneration circuit D18 to D20. Q9 and 10 is an inverting amplifier for auto focusing, and it creates the focus voltage from the blanking signal. The focus voltage is overlapped with the high voltage at the DC regeneration circuit D14 to D16, and drives the focus electrode. The −1.5 kV power for the cathode is generated by the Q15 oscillation transistor and the high voltage convertor block (W02-0431-05). In order for the convertor oscillation circuit to obtain stable high voltage, negative feedback is applied from the cathode to the error amplifier U4 and Q14.

Trigger Circuit (X74-1470-00)

The trigger signal selected by the vertical pre-amp is input to the trigger amp Q1 and Q2 through P11. The coupling method for the Q2 output is selected by TRIGGER COUPLING switch S2. Input is to the Q3 to Q8 circuit when AC, HF REJ, or DC, and to the Q10, 11, 13, 14, and 15 circuit when TV sync, and the input is amplified to the level at which the ECL logic operates. Q10, D4 and 5 form a polarity selection circuit for TV sync. The sync tip is clamped by Q13 and D6 and the sync pulses are extracted by Q15. The vertical sync pulses are obtained by the R52, C15, and C16 integration circuit.

The trigger slope of the signal output from the trigger amp is switched by U101a after waveform shaping by the U101b, c Schmitt circuit. The next stage horizontal sweep circuit is driven by this signal sync pulse.

The trigger pulse passes through the U103d and D103 detection circuit and is input to the Q101 and 102 flip-flop. When there is a trigger pulse, the base of Q101 goes to "H" and the collector of Q102 goes to "H". It further passes through U103c and the U102b RESET terminal goes to "L". At this time, U102b is in a state able to receive trigger pulses. When there is no trigger pulse, the U102b RESET terminal goes to "H", the RESET state is selected, and auto freerun starts.

Horizontal Sweep Circuit (X74-1470-00)

When the trigger pulse triggers flip-flop U102b, the output of U102b is inverted and Q105 is controlled through Q114. A sweep signal matching the CR time constant selected by U105 to U108 and Q107 to Q109 is then generated. This sweep signal passes through U206 and Q203 and is sent to the horizontal output selection circuit. This signal is also sent to the Q115 and 116 comparator circuit and the sweep length is determined here. The holdoff time is determined by C121 to C124 which are switched by U104a, R137, VR102 and Q110 to Q112.

<Real Time Mode>

U105	← sec					← msec								µsec					
U106	.2	.1	50	20	10	5	2	1	.5	.2	.1	50	20	10	5	2	1	.5	.2
A	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
B	H	H	L	L	H	H	H	H	L	L	H	H	H	H	L	L	H	H	L
C	L	L	H	H	H	H	L	L	H	H	H	H	L	L	H	H	H	H	L

<Equivalent Time Sampling Mode>

U107	µsec ← nsec			
U108	.1	50	20	10
A	L	L	L	H
B	L	H	H	L
C	H	L	H	L

Sampling Pulse Generation Circuit (X74-1470-00)

A sawtooth wave with a period of approx. 10 ms is created by U204a, U407, and Q401 to Q403. This sweep signal and the high-speed sweep signal for 10 ns/div to 0.1 µs/div are compared by the Q404 to Q406 comparator, and this comparator output signal passes through P68 and is sent to the vertical pre-amp unit as the sampling clock.

Blanking Circuit (X74-1470-00)

The output signal from the sweep gate flip-flop U102b enters the Q118 and 119 ECL to TTL conversion circuit. The Q118 output is sent to U204a and is used as the trigger pulse to generate the low-speed sweep signal of the equivalent time sampling circuit. The output from Q119 is sent to Q211 through the various gates, U403b, U405c, U201a, U201d, and U201c.

U202c, U202d is a CHOP oscillator which oscillates at approx. 500 kHz. This CHOP signal is mixed with the sweep gate by U201a. It is then divided by 1/2 by U204, passes through U202a and b, and is sent to the vertical amp board (X73-1750-00) from P12 as the vertical selection signal.

The $\overline{\text{R/O BL}}$ signal is prolonged for a certain period and mixed with the sweep gate signal by U201c. Then, the $\overline{\text{R/O UNBL}}$ signal is sent to Q213. The blanking signal and unblanking signal are mixed by Q212, Q214 and output from Q215. U205b is a comparator to create the $\overline{\text{R/O OFF}}$ signal.

CIRCUIT DESCRIPTION

Horizontal Output Selection Circuit (X74-1470-00)

The real sweep signal, XY signal, or low-speed sweep signal for display at the equivalent time sampling mode is selected by Q204 to Q207, Q410 and Q411, passes through Q208 and 209, and is sent to the horizontal final amp from P24.

Horizontal Final Circuit (X80-1090-00)

The horizontal signal input from P24 passes through the emitter follower of Q23, Q24, and is then sent to Q25, Q26 or Q27, Q28 (for X10 MAG). Switching between Q25, Q26 and Q27, Q28 is by the selection circuit formed from Q44 and Q45. Q29, Q30 is the base ground stage of the cascode amp and the D12 to D21 limiters are connected to the output collector. The horizontal signal is impedance converted by the Q31, Q32 emitter follower, and is amplified to approx. 6 V/div (one side) by the Q33 to Q40 and Q50 final amp.

Thermistor TH3 for compensation of gain temperature drift is mounted between the Q25 and Q26 emitters. There is also thermistor TH4 for compensation of gain temperature drift between the Q27 and Q28 emitters.

VR6 is a VR for horizontal position adjustment and VR7 is for adjustment of the NORM/MAG center. VR7 is mounted on the NORM side in order to allow for a full variable range. VR9 is a VR for adjustment of the operating point, and this is used to set the output operating point to +60 V.

The readout signal is input to Q47 and Q48. Switching between Q47, 48 and Q25, Q26 (or Q27, Q28) is performed by the $\overline{\text{RO REQUEST}}$ signal. D5 and 6 have been added to improve isolation between Q47, 48 and Q25, 26 (or Q27, Q28). VR11 is a VR for adjustment of the cursor gain and VR10 is for adjustment of the cursor position.

Overview of Equivalent Time Sampling

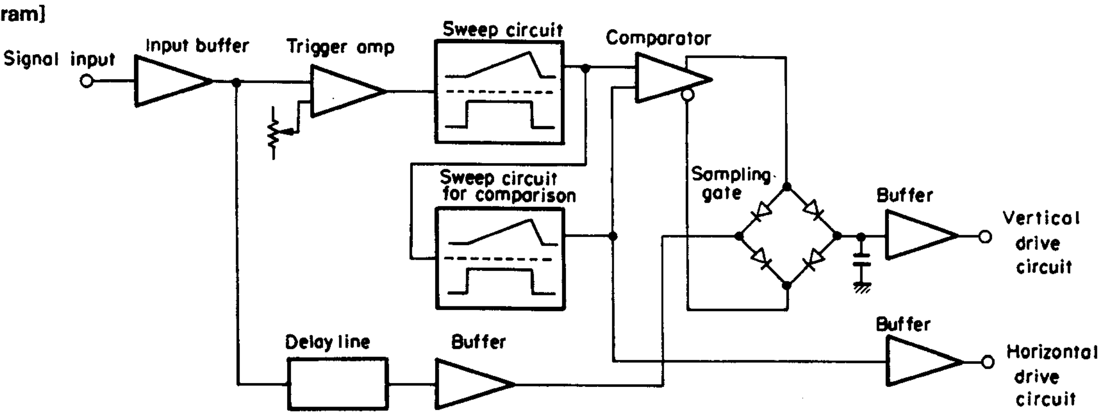
In order to allow the CS-5140 to monitor high frequency signals without the use of a high-band amplifier, an equivalent time sampling system is used which converts both the input signal and sweep signal at low speed for screen display. The vertical axis frequency band is 100 MHz (−3 dB). The horizontal axis is converted to approximately 0.7 ms/div in the range of 0.1 μs/div to 10 ns/div, and displayed. The following is a description of the operational principles of the equivalent time sampling method used in this unit. (Refer to block diagram and time chart.)

After the input signal passes through the input buffer, it is sent to a trigger amp and delay line for monitoring the leading edge. A trigger pulse is created in the trigger amp, and a high-speed sawtooth wave (0.1 μs/div to 10 ns/div) synchronized to this pulse is created by the sweep circuit. A low-speed comparison sawtooth wave (approx. 0.7 ms/div) for synchronized to this sweep signal is created by the sweep circuit for comparison. This low-speed sweep signal is also used as the horizontal axis signal for CRT display.

These two sawtooth waves are compared by the comparator, and the sampling pulse is created. Opening and closing of the diode configured sampling gate by this sampling pulse causes sampling and hold of the input signal which passed through the delay line and the buffer. At this time, the input signal is sampled at the point where is gradually shifts in time for each period of the high-speed sweep. This sampled signal is displayed in the vertical axis direction of the CRT, and the low-speed sawtooth wave for comparison is displayed in the horizontal axis direction of the CRT. The above operation allows for high frequency signals to be reproduced on the CRT as a low frequency signal with low-speed sweep while retaining the same waveform as when displayed at high-speed.

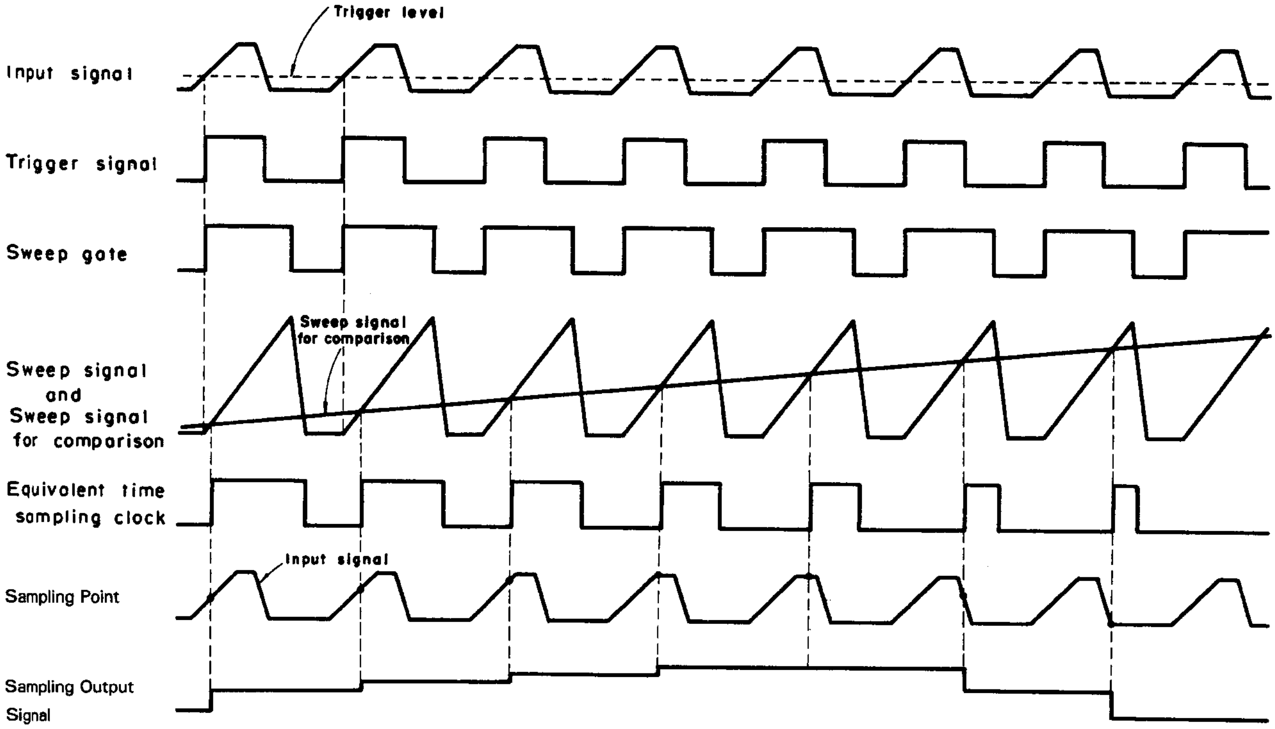
Equivalent Time Sampling

[Block Diagram]



CIRCUIT DESCRIPTION

[Time Chart]


Trigger level
Input signal
Trigger signal
Sweep gate
Sweep signal for comparison
Sweep signal and Sweep signal for comparison
Equivalent time sampling clock
Input signal
Sampling Point
Sampling Output Signal

Overview of Readout R/O Unit (X77-1450-00)

The R/O unit is configured from the following three functional blocks.

1) Inport section

Section which fetches switch information and clock data for the CRT readout display (Configured by ICs U17 to U24)

2) Display section

Section which creates X-axis signal and Y-axis signal for the CRT readout display (Configured by ICs and resistors U1 to U5, U7, U8, U13, and R33)

3) Cursor section

A/D conversion section and calculation section for the cursor measurement

(Configured by ICs U6, U8 to U11, U14, and U23)

Inport Section

Fetching the information from the various operation switches and the clock data and sending these data to the character generator U7 are performed by the single-chip MPU U23. The reference clock is given from the 10 MHz oscillator configured from U16 and X1. This MPU outputs the lower address A0 to A7 onto the data bus by time division.

U18 latches the lower address by the ALE signal output from the MPU.

The switch information need for screen display passes through the input ports configured by U19 to U22, and this is fetched by the MPU every 80 msec. U17 is the input port decoder, and the output signals $\overline{\text{RS0}}$ to $\overline{\text{RS3}}$ are output at a cycle of 80 msec.

The information from time setting switches S1 to S3 passes through MPU I/O port P1 and is fetched by the MPU every 80 msec.

If the pulses output from Pin 1 of the clock IC U24 every 1 minute apply an interrupt to the MPU, the MPU accesses U24 and fetches the clock data.

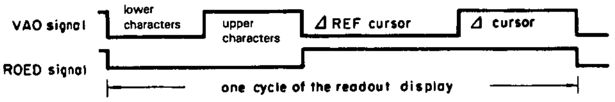
Even when the power is off, U24 is backed up by lithium battery B1, and the 32.768 kHz reference clock is properly generated by crystal oscillator X2. If the battery becomes old and the voltage is less than 2 V when the power is off, the clock will slow down as this reference clock will not be properly generated, and the BATT. DOWN indication will appear on the screen. Clock data protection when the power is switched on/off is performed by IC U25 for +5 V power detection (detection level: TYP +4.4 V).

CIRCUIT DESCRIPTION

Display Section

Character display is by the random scan method (X-Y display), and the character generator U7 is controlled by the character counter (U8 CD1 to CD7) and the dot counter (U8 DC0 to DC4) of the R/O controller U8. In the real mode, readout display is performed at a period of 13.5 msec. In the storage mode, readout display and storage display is performed by time division with a readout display period of approx. 10 msec and a storage display period of approx. 4 msec. The control signals in this case are the ROED ($\overline{\text{R/O END}}$) signal and the RSTR ($\overline{\text{R/O START}}$) signal from the A/D unit (X78-1030-00). (In the storage display period, RSTR becomes "H" and the readout operation stops.)

One cycle of the readout display is divided into four and this consists of the lower characters, upper characters, Δ REF cursor, and Δ cursor. This timing is switched by the U8-Pin89 ROED signal and U8-Pin46 VAO signal.



The character generator U7 contains character data with a 5 × 7 dot configuration. The 3 bits DD0 to DD2 are the X-axis data, the 4 bits DD3 to DD6 are the Y-axis data, and DD7 is a control bit for character start and end. The digital signals output from U7 are converted to analog signals by the X-axis signal D/A convertor U1 and the Y-axis signal D/A convertor configured by U3 and R33. These signals pass through the analog switches U4 and U5 and the buffer amp U13, and both the X-axis signal and the Y-axis signal are fed to the final unit (X80-1090-00). The character dot display is controlled by the ROUB signal (U8-Pin86), ROB signal (U8-Pin87), and ROQ signal (U8-Pin88). The real waveform display is deleted by the ROB signal, switching between the real waveform and readout is by the ROQ signal, and readout dot display is by the ROUB signal. The above three types of signals are controlled by the ROSP signal (readout off signal $\overline{\text{R/O OFF}}$) from the Pin 83 of U8.

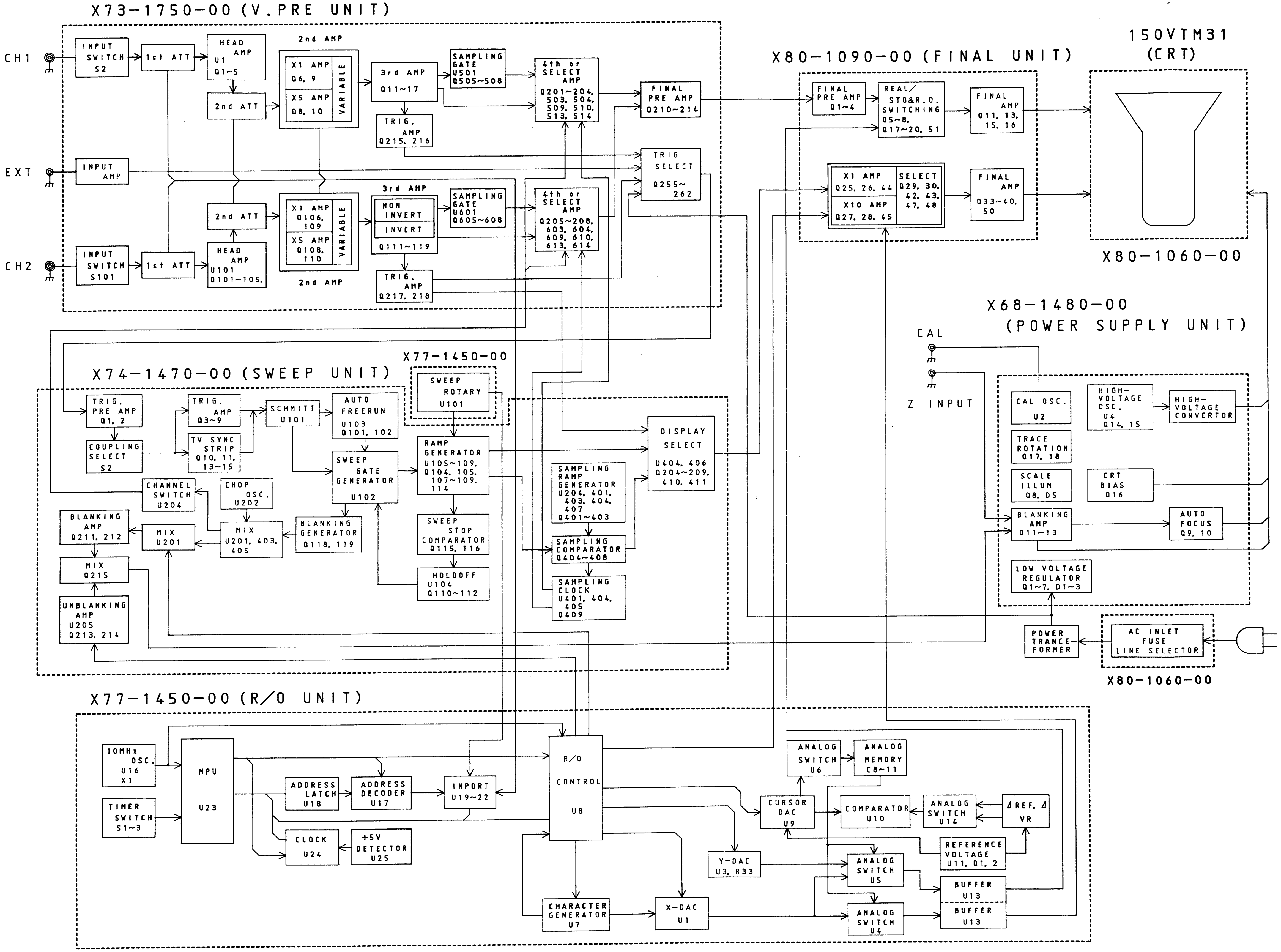
Cursor Section

The reference voltage for the cursor is ± 1.25 V, created by resistor division of the power supply voltage of + 10 V. It passes through U11, Q1, and Q2, and is output. This reference voltage of ± 1.25 V corresponds to the full scale voltage for 10 bit cursor measurement resolution, and is fed to both terminals of the cursor VR. The voltage set by the cursor VR is fed directly to analog switch U14 in the case of X-axis measurement, and for Y-axis measurement it is attenuated to 80% before being fed to the same analog switch. U14 is for switching between Δ T and Δ V and for switching between Δ REF and Δ.

MPU U23 sends 10 bit data to D/A convertor U9, and this 10 bit data is converted to analog voltage. Comparator U10 compares this analog voltage and voltage from the cursor VR, and returns the output to MPU U23. By this process, an A/D convertor is configured by U8, U9, U10, and U23. This A/D convertor converts the analog voltage from Δ REF and Δ cursor VR to 10bit digital data. The conversion speed of this A/D conversion is 80 msec. Next, this converted 10bit digital data is used for cursor calculation by MPU U23.

The analog voltage output from D/A convertor U9 is converted into Δ REF and Δ cursor signals by analog switch U6, and is held every 80 msec as the cursor display voltage by the various hold circuits.

BLOCK DIAGRAM


X73−1750−00 (V.PRE UNIT)
CH1
EXT
CH2
INPUT SWITCH S2
1st ATT
HEAD AMP U1 Q1~5
2nd ATT
2nd AMP
X1 AMP Q6, 9
X5 AMP Q8, 10
VARIABLE
3rd AMP Q11~17
SAMPLING GATE U501 Q505~508
4th or SELECT AMP Q201~204, 503, 504, 509, 510, 513, 514
FINAL PRE AMP Q210~214
TRIG. AMP Q215, 216
INPUT AMP
TRIG SELECT Q255~262
2nd ATT
X1 AMP Q106, 109
X5 AMP Q108, 110
3rd AMP
NON INVERT
INVERT
Q111~119
SAMPLING GATE U601 Q605~608
4th or SELECT AMP Q205~208, 603, 604, 609, 610, 613, 614
TRIG. AMP Q217, 218
INPUT SWITCH S101
1st ATT
HEAD AMP U101 Q101~105
2nd AMP
X80−1090−00 (FINAL UNIT)
FINAL PRE AMP Q1~4
REAL/ STO&R.O. SWITCHING Q5~8, Q17~20, 51
FINAL AMP Q11, 13, 15, 16
X1 AMP Q25, 26, 44
X10 AMP Q27, 28, 45
SELECT Q29, 30, 42, 43, 47, 48
FINAL AMP Q33~40, 50
150VTM31 (CRT)
X80−1060−00
X68−1480−00 (POWER SUPPLY UNIT)
CAL
Z INPUT
CAL OSC. U2
HIGH-VOLTAGE OSC. U4 Q14, 15
HIGH-VOLTAGE CONVERTOR
TRACE ROTATION Q17, 18
SCALE ILLUM Q8, D5
CRT BIAS Q16
BLANKING AMP Q11~13
AUTO FOCUS Q9, 10
LOW VOLTAGE REGULATOR Q1~7, D1~3
POWER TRANCE-FORMER
AC INLET FUSE LINE SELECTOR
X80−1060−00
X77−1450−00
SWEEP ROTARY U101
X74−1470−00 (SWEEP UNIT)
TRIG. PRE AMP Q1, 2
TRIG. AMP Q3~9
SCHMITT U101
AUTO FREERUN U103 Q101, 102
COUPLING SELECT S2
TV SYNC STRIP Q10, 11, 13~15
SWEEP GATE GENERATOR U102
RAMP GENERATOR U105~109, Q104, 105, 107~109, 114
DISPLAY SELECT U404, 406 Q204~209, 410, 411
CHANNEL SWITCH U204
CHOP OSC. U202
SAMPLING RAMP GENERATOR U204, 401, 403, 404, 407 Q401~403
BLANKING AMP Q211, 212
MIX U201
MIX U201, 403, 405
BLANKING GENERATOR Q118, 119
SWEEP STOP COMPARATOR Q115, 116
SAMPLING COMPARATOR Q404~408
MIX Q215
HOLDOFF U104 Q110~112
SAMPLING CLOCK U401, 404, 405 Q409
UNBLANKING AMP U205 Q213, 214
X77−1450−00 (R/O UNIT)
10MHz OSC. U16 X1
MPU U23
TIMER SWITCH S1~3
ADDRESS LATCH U18
ADDRESS DECODER U17
INPORT U19~22
R/O CONTROL U8
CLOCK U24
+5V DETECTOR U25
ANALOG SWITCH U6
ANALOG MEMORY C8~11
CURSOR DAC U9
COMPARATOR U10
ANALOG SWITCH U14
⊿REF.⊿ VR
REFERENCE VOLTAGE U11, Q1, 2
Y-DAC U3, R33
ANALOG SWITCH U5
BUFFER U13
BUFFER U13
CHARACTER GENERATOR U7
X-DAC U1
ANALOG SWITCH U4

ADJUSTMENT

To obtain the best performance, periodically calibrate the unit. Sometimes, only one mode need be calibrated, while at other times, all modes should be calibrated. When one mode is calibrated, it must be noted that the other modes may be affected. When calibrating all modes, perform the calibration in the specified sequence.

The following calibration required an accurate measuring instrument and an insulated adjusting flat blade screwdriver. If they are not available, contact your dealer.

For optimum adjustment, turn the power on and warm up the scope sufficiently (more than 30 minutes) before starting.

Before calibrating the scope, check the power supply voltage.

TEST EQUIPMENT REQUIRED

The following instrument or their equivalent should be used for making adjustment.

Test Equipment	Model	Minimum Specification
Digital Multi-Meter	DL-706 (KENWOOD)	Impedance: More than 10 MΩ, Measuring range: 0.01 V to 199 V
Sine-Wave Generator	651 B (YHP)	Frequency: 10 Hz to 10 MHz, constant voltage over tuning range
Sine-Wave Generator	SG-503 (Tektronix)	Frequency: 50 kHz to 100 MHz, Output impedance: 50 Ω, constant voltage over tuning range
Square-Wave Generator	PG-506 (Tektronix)	Output signal: 1 kHz, Amplitude: 10 mVp-p to 10 Vp-p, Accuracy: within ±1%, Rise time: 35ns or less 100 kHz, Rise time: 1 ns or less
Q Meter	4343B (YHP)	—
Color Pattern Generator	CG-911A (KENWOOD)	—
Oscilloscope	CS-2110 (KENWOOD)	Sensitivity: more than 5 mV Frequency response: More than 100 MHz
Time-Marker Generator	TG-501 (Tektronix)	Time mark: 0.5 s to 0.1 μs repetive waveform
High-Voltage Probe	—	Input Impedance: 1000 MΩ
Termination	—	Impedance: 50 Ω Accuracy: within 3%
Termination	—	3 watts type impedance: 50 Ω
Attenuator	—	−20 dB attenuation (50 Ω)

Table 1

PREPARATION FOR ADJUSTMENT

Control Setting

The control setting listed below must be used for each adjustment procedure.

Exceptions to these settings will be noted as they occur.

After completing a adjustment, return the controls to the following settings.

NAME OF KNOBS	POSITION
INTEN	12 o'clock
READOUT INTEN	Fully CW
FOCUS, ASTIG	Optimum position
CH1, CH2 ▲▼ POSITION	Mechanical center
◄► POSITION/PULL ×10MAG	Mechanical center, push
VARIABLE, H.VARIABLE (VOLTS/DIV, SWEEP TIME/DIV)	CAL
AC-GND-DC (CH1 and CH2)	DC (GND at no signal)
Vertical MODE	CH1
CH2 PULL INV	Push (NORM)
TRIGGERING COUPLING	AC
TRIGGERING SOURCE	CH1
TRIGGERING LEVEL	Mechanical center, push
TRIGGERING MODE	AUTO
VOLTS/DIV (CH1 and CH2)	10 mV/DIV
SWEEP TIME/DIV	1 ms/DIV
HOLDOFF	NORM

Table 2

ADJUSTMENT

1. POWER SUPPLY AND CRT SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
−10 V Adjustment	VR1	X68-1480	Adjust VR1 so that the voltage at pin 2 of the connector P41 is −10 V.
Focus Center Adjustment	VR4	X68-1480	Push the FOCUS knob in (for the FOCUS operation) and then set it to the mechanical center position. Pull the knob out (for the ASTIG operation), display a spot on the screen, and adjust the ASTIG control and VR4 to minimize the dimension of the spot.
Intensity Adjustment	VR2	X68-1480	Display the spot on the CRT screen, and adjust VR2 so that the spot disappears when the INTEN knob is set to the 10-o'clock position.
CRT Center Adjustment	VR2	X80-1090	Short circuit the line between Q1's collector and Q2's collector. Adjust VR2 so that the luminescent line is moved to the center of the CRT screen.
Vertical Center Voltage Adjustment	VR5	X80-1090	With the line between Q1's collector and Q2's collector short-circuited, adjust VR5 so that the voltage at pin 1 of the connector P42 becomes 37 V.
Horizontal Center Voltage Adjustment	VR9	X80-1090	Activate the X-Y operation mode, and set so that the spot moves to the center of the CRT. Adjust VR9 so that the voltage at pin 1 of the connector P43 becomes 60 V.

2. VERTICAL SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH1 100 Hz Square Wave Adjustment	VR2	X73-1750	CH1 VOLTS/DIV: 10 mV Adjust the output of the square wave oscillator so that the amplitude on the CRT screen becomes 6 div. Adjust VR2 so that the waveform becomes flat.
CH2 100 Hz Square Wave Adjustment	VR102	X73-1750	Adjust in the same way as for CH1.
CH1 Waveform Shaping	TC903 TC904	X73-1750 X73-1750	AC-GND-DC: DC Apply 1 kHz square wave to CH1 INPUT (with the amplitude extending over 4 to 6 div). Set CH1 VOLTS/DIV to 0.1 V range (and 1 V range), and adjust TC903 (and TC904) so that the waveform becomes flat in both ranges.
CH2 Waveform Shaping	TC913 TC914	X73-1750 X73-1750	Adjust in the same way as for CH1.
CH1 Input Capacity Adjustment	TC901 TC902	X73-1750 X73-1750	AC-GND-DC: DC CH1 VOLTS/DIV: 10 mV Connect the capacity meter to the CH1 INPUT, and measure the input capacity in the 10 mV range. Adjust TC901 and TC902, alternately, so that the input capacity in the 0.1 V and the 1 V ranges equals the same capacity as in the 10 mV range. Input capacity: 24 pF ± 3 pF
CH2 Input Capacity Adjustment	TC911 TC912	X73-1750 X73-1750	Adjust in the same way as for CH1. Input Capacity: 24 pF ± 3 pF
CH1 Step ATT Balance Adjustment	VR1 VR3	X73-1750 X73-1750	SWEEP TIME/DIV: 1 ms Adjust VR1 so that the position of the luminescent line does not change even when the vertical attenuator is selected between 1 and 2 mV range. Switch the range between 2 and 5 mV ranges, and perform the same adjustment using VR3.

ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH1 Variable Balance Adjustment	VR5	X73-1750	VOLTS/DIV: 10 mV SWEEP TIME/DIV: 1 ms Adjust VR5 so that the position of the luminescent line does not change even if the VARIABLE knob is rotated. Vary the settings of the VOLTS/DIV and VARIABLE controls and see if the trace position also moves; if it does, adjust VR1, 3 and 5 again.
CH2 Step ATT Balance Adjustment	VR101 VR103	X73-1750 X73-1750	Adjust in the same way as for CH1.
CH2 Variable Balance Adjustment	VR105	X73-1750	Adjust in the same way as for CH1.
CH2 INV Balance Adjustment	VR108	X73-1750	CH2 POSITION: Mechanical center position (12-o'clock position) CH2 VOLTS/DIV: 1 mV SWEEP TIME/DIV: 1 ms Adjust VR108 so that the position of the luminescent line does not change even if the polarity of CH2 is switched over between NORM and INV positions (with the CH2 POSITION knob set to PUSH and PULL status).
CH2 Position Center Adjustment	VR601 VR604	X73-1750 X73-1750	CH2 POSITION: Mechanical center position CH2 VOLTS/DIV: 10 mV SWEEP TIME/DIV: 1 ms Adjust VR604 so that the trace is located on the center of the screen. Set the SWEEP TIME to 0.1 μs and adjust VR601 so that the trace is located on the center of the screen.
CH1 Position Center Adjustment	VR501 VR504	X73-1750 X73-1750	Adjust in the same way as for CH2. Adjust VR504 when the SWEEP TIME/DIV is set to 1 ms. And adjust VR501 when the setting is 0.1 μs.
CH1 Sampling 10 kHz Square Wave Adjustment	VR503	X73-1750	CH1 VOLTS/DIV: 10 mV SWEEP TIME/DIV: 0.1 μs Input a 10 kHz square wave signal into CH1 INPUT, and adjust oscillator so that the CRT samplitude becomes 6 div. Turn a TRIG LEVEL knob fully clockwise or counterclockwise and release the synchronization. Adjust VR503 so that the waveform on the CRT becomes flat.
CH2 Sampling 10 kHz Square Wave Adjustment	VR603	X73-1750	CH2 VOLTS/DIV: 10 mV SWEEP TIME/DIV: 0.1 μs Input a 10 kHz square wave signal into CH2 INPUT, and adjust in the same way as for CH1.
CH1 Gain Adjustment	VR1	X80-1090	CH1 VOLTS/DIV: 10 mV Input a square wave signal having an amplitude of 50 mV, and adjust VR1 so that the CRT amplitude becomes 5 div.
CH1 1 mV Range Gain Adjustment	VR4	X73-1750	CH1 VOLTS/DIV: 1 mV Input a square wave signal having an amplitude of 5 mV, and adjust VR4 so that the CRT amplitude becomes 5 div.
CH1 Sampling Gain Adjustment	VR502	X73-1750	CH1 VOLTS/DIV: 10 mV SWEEP TIME/DIV: 10 ns Input a square wave signal having an amplitude of 50 mV into CH1 INPUT. Turn a TRIG LEVEL knob fully clockwise or counterclockwise and release the synchronization. Adjust VR502 so that the CRT amplitude becomes 5 div.
CH2 Gain Adjustment	VR605	X73-1750	Adjust in the same way as for CH1.
CH2 1 mV Range Gain Adjustment	VR104	X73-1750	Adjust in the same way as for CH1.

ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH2 Sampling Gain Adjustment	VR602	X73-1750	CH2 VOLTS/DIV: 10 mV SWEEP TIME/DIV: 10 ns Input a square wave signal having an amplitude of 50 mV into CH2 INPUT, and adjust in the same way as for CH1.
X Gain Adjustment	VR202	X73-1750	CH2 VOLTS/DIV: 10 mV TRIGGERING MODE: X-Y Input the square wave signal having an amplitude of 50 mV into CH2 INPUT, and adjust VR202 so that the CRT amplitude in the horizontal direction becomes 5 div.

3. TRIGGER SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
Trigger Level Center Adjustment	VR1	X74-1470	TRIGGERING MODE : AUTO SOURCE : CH1 COUPLING : AC LEVEL : Mechanical center CH1 VOLTS/DIV : 10 mV Input a 1 kHz sine wave into CH1 INPUT, and adjust the oscillator so that the CRT amplitude becomes 6 div. Adjust VR1 so that start point of the luminescent line is at the center of the CRT (vertical direction).

4. HORIZONTAL SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
1 ms Range Sweep Time Adjustment	VR201	X74-1470	SWEEP TIME/DIV: 1 ms Input a 1 ms marker signal into CH1 INPUT. Adjust VR201 so that the peak of the marker signal matches the CRT scale divided in 1 div.
10 ms Range Sweep Time Adjustment	VR101	X74-1470	SWEEP TIME/DIV: 10 ms Input a 10 ms marker signal into CH1 INPUT, and adjust in the same way as for 1 ms adjustment.
0.2 µs Range Sweep Time Adjustment	TC102	X74-1470	SWEEP TIME/DIV: 0.2 µs Input a 0.2 µs marker signal into CH1 INPUT, and adjust in the same way as for 1 ms adjustment.
1 µs Range Sweep Time Adjustment	TC101	X74-1470	SWEEP TIME/DIV: 1 µs Input a 1 µs marker signal into CH1 INPUT, and adjust in the same way as for 1 ms adjustment.
Leading Edge Adjustment	VR401	X74-1470	SWEEP TIME/DIV: 10 ns Input a 1 MHz square wave signal into CH1 INPUT, and adjust oscillator so that the CRT amplitude becomes 6 div. Adjust a TRIG LEVEL to synchronize the signal so that the leading edge on the CRT becomes longer. Adjust VR401 so that the length of the leading edge becomes 0.5 div.
20 ns Range Sweep Time Adjustment	VR403	X74-1470	SWEEP TIME/DIV: 20 ns Input a 20 ns marker signal into CH1 INPUT, and adjust in the same way as for 1 ms adjustment.

ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
X10 MAG Gain Adjustment	VR8	X80-1090	SWEEP TIME/DIV: 1 ms Input a 1 ms marker signal into CH1 INPUT, and match the peak of the marker signal with the CRT scale divided in 1 div. Pull the PULL X10 MAG knob (to set to the X10 MAG status), and adjust VR8 so that the interval between peaks becomes 10 div.
X10 MAG Center Adjustment	VR7	X80-1090	SWEEP TIME/DIV: 1 ms Input a 5 ms marker signal into CH1 INPUT. Pull the PULL X10 MAG knob (to set to the X10 MAG status), and adjust the horizontal POSITION so that the peak of the waveform is at the vertical scale line at the center of the CRT. Push the PULL X10 MAG knob (to release the X10 MAG mode) and adjust VR7 so that the peak of the waveform matches the vertical scale line at the center of the CRT.
X10 MAG Linearity Adjustment	TC4	X80-1090	SWEEP TIME/DIV: 0.2 μs PULL X10 MAG: PULL Input a 20 ns marker signal into CH1 INPUT, and match the first peak of the waveform with the vertical scale line at the left end of the CRT. Adjust TC4 so that the peaks of the marker signal waveform match the CRT scale divided in 1 div.
Horizontal Position Center Adjustment	VR6	X80-1090	SWEEP TIME/DIV: 1 ms Horizontal POSITION:Mechanical center Adjust VR6 so that the start point of the luminescent line matches the vertical scale line at the left end of the CRT.
Sampling Horizontal Position Center Adjustment	VR404	X74-1470	SWEEP TIME/DIV: 1 ms Adjust the horizontal POSITION knob so that the sweep start point moves to the vertical scale line at the left end of the CRT. Set the SWEEP TIME/DIV to 0.1 μs and adjust VR404 so that the start point of the luminescent line matches the vertical scale line at the left end of the CRT.
X Position Center Adjustment	VR202	X74-1470	SWEEP TIME/DIV: 1 ms Adjust the horizontal POSITION knob so that the sweep start point moves to the vertical scale line at the left end of CRT. Switch to the X-Y mode and adjust VR202 to bring the spot to the center of CRT screen.

ADJUSTMENT

5. OVERSHOOT AND CAL ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
Sampling Overshoot Adjustment	<For CH1> VR8 TC1 TC2 TC501 <For CH2> VR109 TC101 TC102 TC601	 X73-1750 X73-1750 X73-1750 X73-1750 X73-1750 X73-1750 X73-1750 X73-1750	• Input a 1 MHz square wave signal into CH1 INPUT (with a CRT amplitude of 6 div.). * Adjust TC501 so that the overshoot becomes minimum. * Adjust TC2 so that the overshoot becomes maximum. * Turn VR8 fully clockwise. * Adjust TC1 so that the overshoot appears. * Adjust TC501 so that the ringing becomes 0.2 div. * Adjust TC1 so that the overshoot becomes 0.7 div. After adjustment, check if the frequency responses of 10 mV and 50 mV ranges are more than 115 MHz (−3 dB). • Input a 1 MHz square wave signal into CH2 INPUT (with a CRT amplitude of 6 div.). * Adjust TC601 so that the overshoot becomes minimum. * Adjust TC102 so that the overshoot becomes maximum. * Turn VR109 fully clockwise. * Adjust TC101 so that the overshoot becomes maximum. * Adjust TC601 so that the overshoot becomes 0.7 div. After adjustment, check if the frequency responses of 10 mV and 50 mV ranges are more than 115 MHz (−3 dB).
Overshoot Adjustment	TC1 TC2 <For CH1> VR201 TC201 <For CH2> TC602	X80-1090 X80-1090 X73-1750 X73-1750 X73-1750	CH1, 2 VOLTS/DIV : 10 mV CH1, 2 AC-GND-DC : DC SWEEP TIME/DIV : 1 μs PULL X10 MAG : PULL • Input a 1 MHz square wave signal into CH1 INPUT (with a CRT amplitude of 6 div.). * Adjust TC1 and 2 (X80) so that the middle frequency band of the waveform becomes flat. * Adjust TC201 (X73) so that the overshoot becomes 0.1 div. * Adjust VR201 (X73) so that the ringing becomes 0.1 div. • Input the 1 MHz square wave signal into CH2 INPUT (with the CRT amplitude of 6 div.). * Adjust TC602 (X73) so that the overshoot becomes 0.1 div. After adjustment, check if the frequency response is more than 43 MHz (−3 dB).
CAL Adjustment	VR5 VR6	X68-1480 X68-1480	Connect an oscilloscope having a measurement band of 100 MHz (−3 dB) or more to CAL terminal, and set the VOLTS/DIV to 0.2 V and the SWEEP TIME/DIV to 0.1 ms. (The oscilloscope should be calibrated beforehand.) Adjust VR5 so that one period becomes 1 ms (10 div.). Adjust VR6 so that the amplitude becomes 1 V (5 div.).

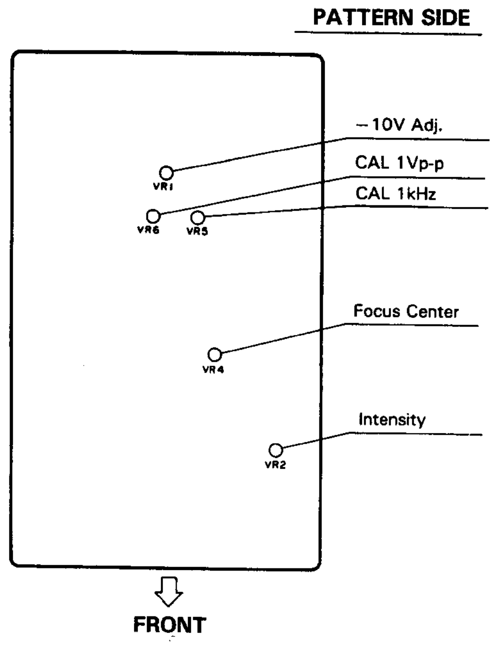
ADJUSTMENT

6. CURSOR SECTION ADJUSTMENTS

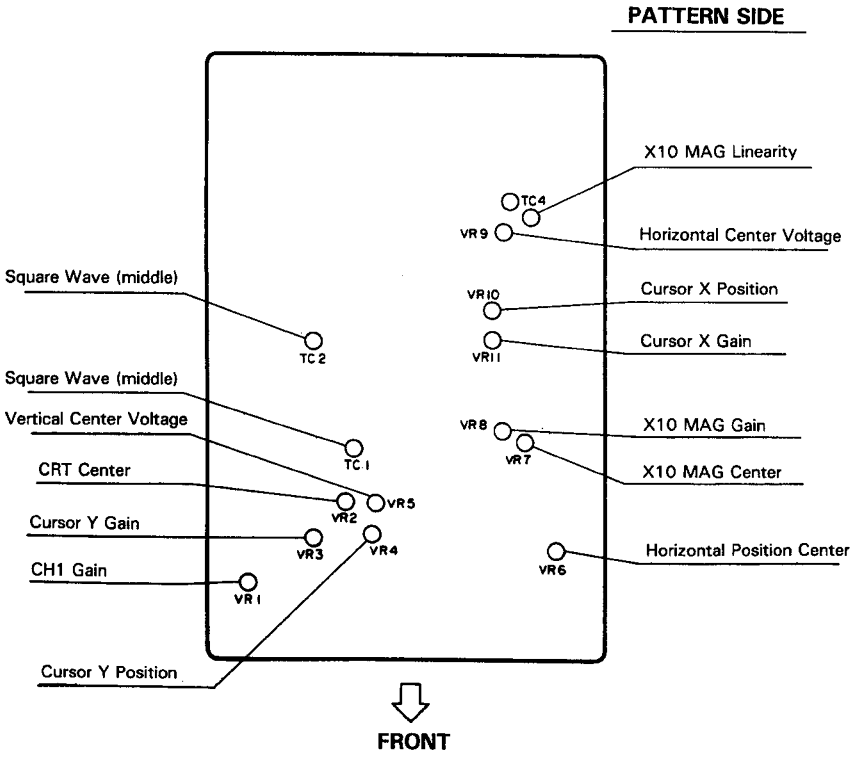
Item	Adjustment VR (TC)	P.C.B.	Procedure
Cursor Y Gain Adjustment	VR3 VR4	X80-1090 X80-1090	CURSORS : Δ V1 Δ : Turn fully clockwise Δ REF : Turn fully counterclockwise CH1 VOLTS/DIV : 10 mV • Adjust VR3 so that the interval between cursors becomes 8 div. To facilitate the adjustment of VR3, adjust VR4 to move the cursor in the Y direction. • Then, input a square wave signal having an amplitude of 50 mV into CH1 INPUT. After confirming that the CRT amplitude is 5 div., adjust the Δ and Δ REF knobs to move the cursor on the waveform. Confirm that the cursor data indication is 50.0 mV±3%. (48.5 -51.5 mV) If it is not within the above allowable range, adjust the Δ REF knob so that the data indication becomes 50.0 mV, and readjust VR3 and VR4 (X80-1090) so that the cursor is on the square wave.
Cursor Y Position Adjustment	VR4	X80-1090	CURSORS : Δ V1 Δ : Turn fully clockwise Δ REF : Turn fully counterclockwise Adjust VR4 so that the two cursors move to the upper and lower ends of the horizontal scale line in the CRT. If it is impossible, adjust the interval between cursors and the horizontal scale line becomes the same for both upper and lower ends.
Cursor X Gain and Position Adjustment	VR10 VR11	X80-1090 X80-1090	CURSORS : Δ T Δ : Turn fully clockwise Δ REF : Turn fully counterclockwise • Adjust VR11 so that the interval between two cursors becomes 10 div. Adjust VR10 so that the two cursors move onto the vertical scale lines at the left and right ends of CRT. • Then set the SWEEP TIME/DIV to 1 ms, and input the 1 ms marker signal into the CH1 INPUT. After checking that the sweep time is displayed correctly, adjust the Δ REF and Δ knobs so that the cursors move to the second peak and 10th peak of the waveform, respectively. Check that the cursor data indication is 8.00 ms±3% (7.76 - 8.24 ms). If the displayed value is out of the range above, turn the Δ REF control until the data display indicates 8.00 ms, then adjust VR10 and VR11 so as to align the cursors with the 2nd and 10th peaks of the waveform. • Turn the Δ knob fully clockwise again, and turn the Δ REF knob fully counterclockwise. If the cursor positions and the vertical scale lines (at the left end and at the right end) are shifted, adjust VR10 so that the interval becomes the same value for both left and right ends.
R/O Cursor Length Adjustment	VR1	X77-1450	CURSORS : Δ V1 Adjust VR1 to bring the left end of the cursor on the vertical scale line at the first division to the right of the left side of CRT screen.

ADJUSTMENT

POWER SUPPLY UNIT (X68-1480-00)

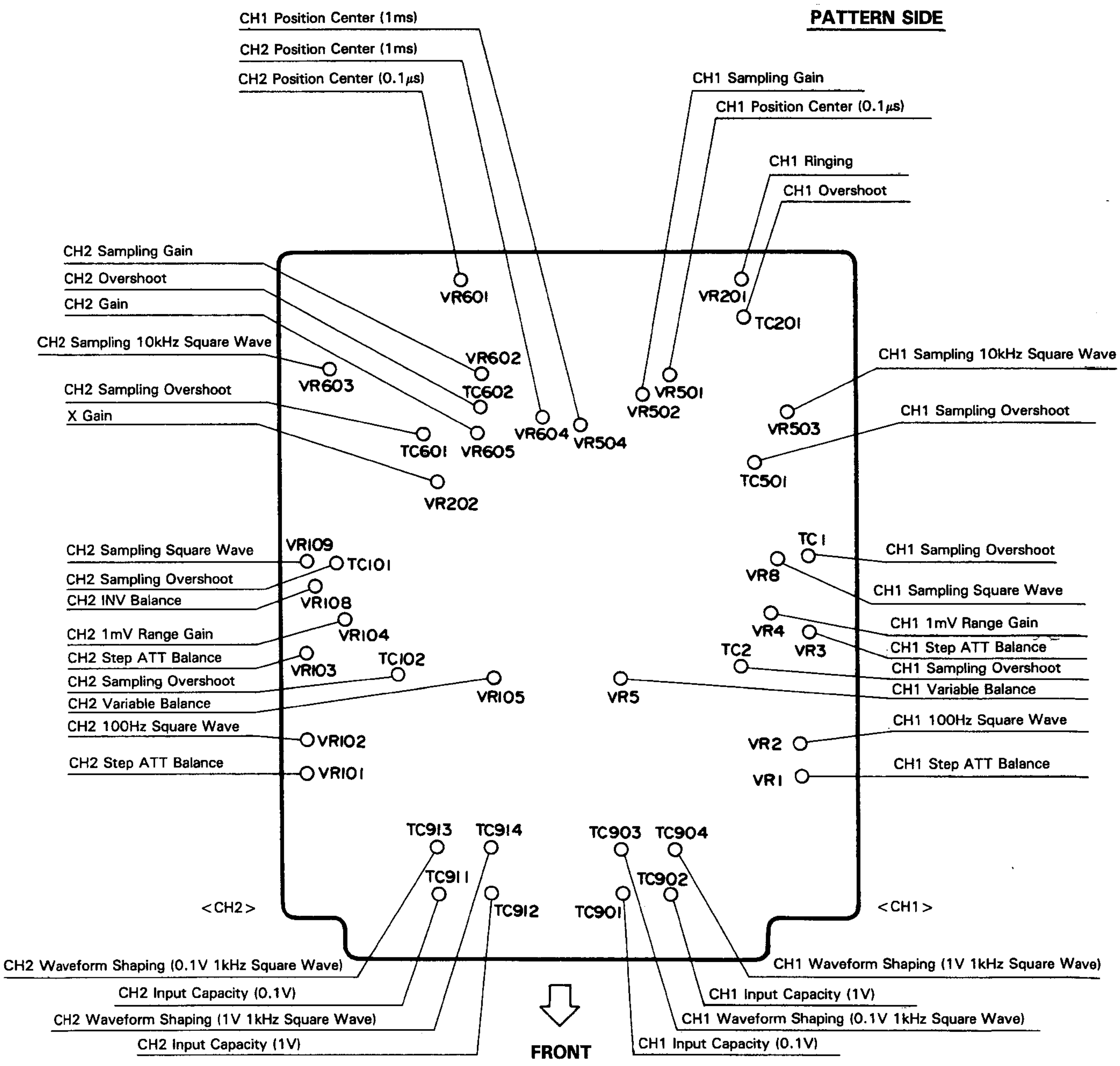

PATTERN SIDE
−10V Adj.
CAL 1Vp-p
CAL 1kHz
VR1
VR6
VR5
Focus Center
VR4
Intensity
VR2
FRONT

FINAL UNIT (X80-1090-00)


PATTERN SIDE
X10 MAG Linearity
TC4
VR9
Horizontal Center Voltage
Square Wave (middle)
VR10
Cursor X Position
TC2
VR11
Cursor X Gain
Square Wave (middle)
Vertical Center Voltage
VR8
X10 MAG Gain
TC1
VR7
X10 MAG Center
CRT Center
VR5
VR2
Cursor Y Gain
VR3
VR4
Horizontal Position Center
CH1 Gain
VR6
VR1
Cursor Y Position
FRONT

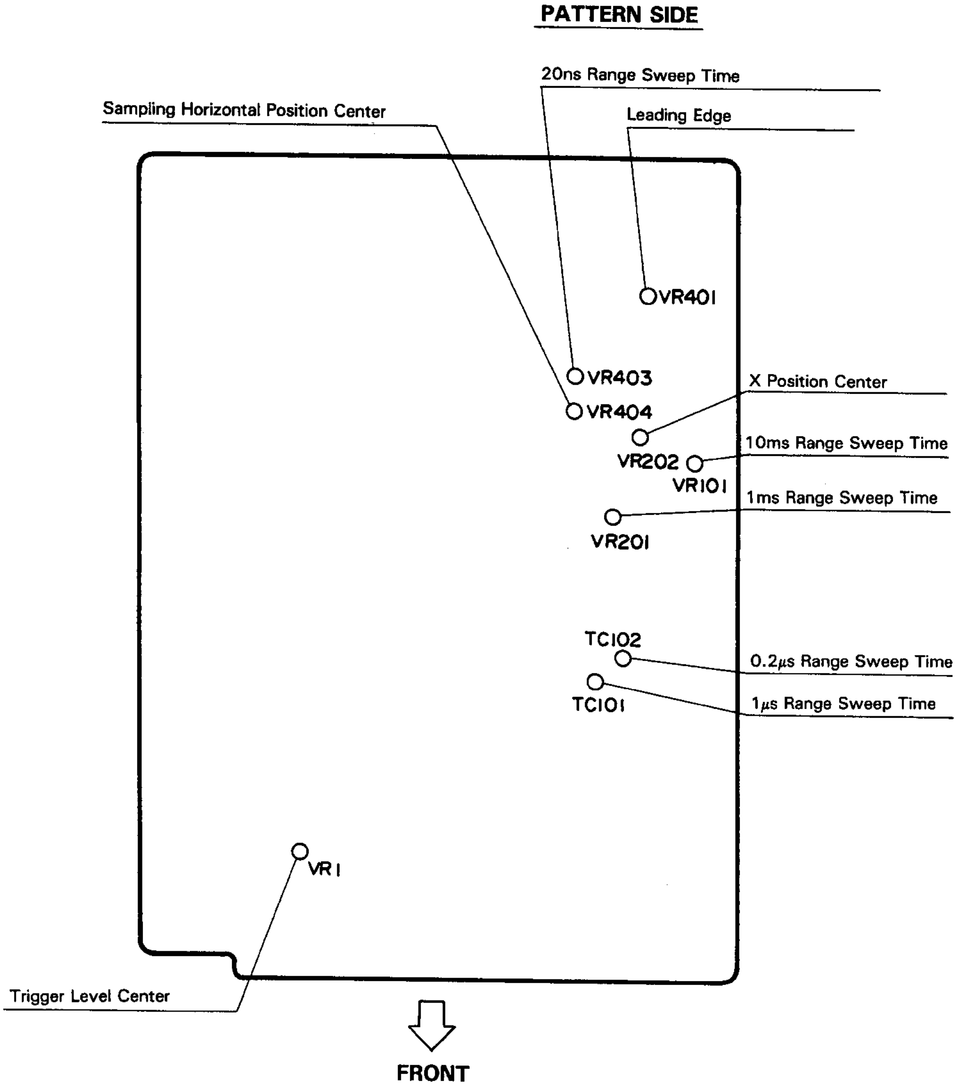
ADJUSTMENT

V.PRE UNIT (X73-1750-00)

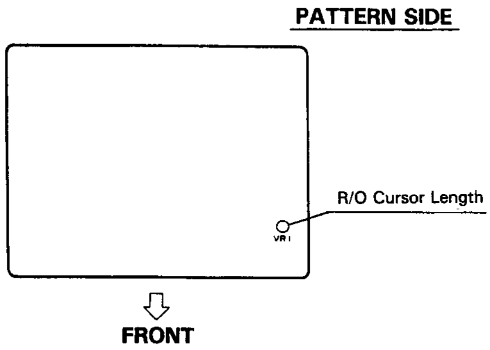

PATTERN SIDE
CH1 Position Center (1ms)
CH2 Position Center (1ms)
CH2 Position Center (0.1μs)
CH1 Sampling Gain
CH1 Position Center (0.1μs)
CH1 Ringing
CH1 Overshoot
CH2 Sampling Gain
CH2 Overshoot
CH2 Gain
CH2 Sampling 10kHz Square Wave
CH2 Sampling Overshoot
X Gain
VR601
VR201
TC201
VR602
TC602
VR603
VR604
VR504
VR501
VR502
VR503
TC601
VR605
VR202
TC501
CH1 Sampling 10kHz Square Wave
CH1 Sampling Overshoot
CH2 Sampling Square Wave
CH2 Sampling Overshoot
CH2 INV Balance
CH2 1mV Range Gain
CH2 Step ATT Balance
CH2 Sampling Overshoot
CH2 Variable Balance
CH2 100Hz Square Wave
CH2 Step ATT Balance
VR109
TC101
VR108
VR104
VR103
TC102
VR105
VR102
VR101
TC1
VR8
VR4
VR3
TC2
VR5
VR2
VR1
CH1 Sampling Overshoot
CH1 Sampling Square Wave
CH1 1mV Range Gain
CH1 Step ATT Balance
CH1 Sampling Overshoot
CH1 Variable Balance
CH1 100Hz Square Wave
CH1 Step ATT Balance
TC913
TC914
TC911
TC912
TC903
TC904
TC902
TC901
<CH2>
<CH1>
CH2 Waveform Shaping (0.1V 1kHz Square Wave)
CH2 Input Capacity (0.1V)
CH2 Waveform Shaping (1V 1kHz Square Wave)
CH2 Input Capacity (1V)
FRONT
CH1 Waveform Shaping (1V 1kHz Square Wave)
CH1 Input Capacity (1V)
CH1 Waveform Shaping (0.1V 1kHz Square Wave)
CH1 Input Capacity (0.1V)

ADJUSTMENT

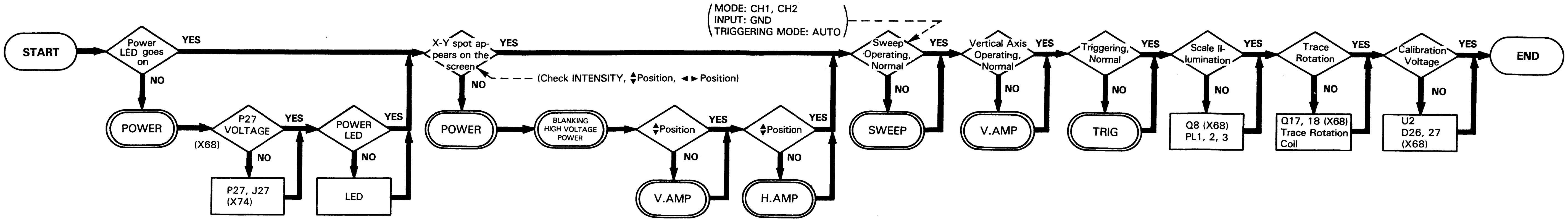
SWEEP UNIT (X74-1470-00)

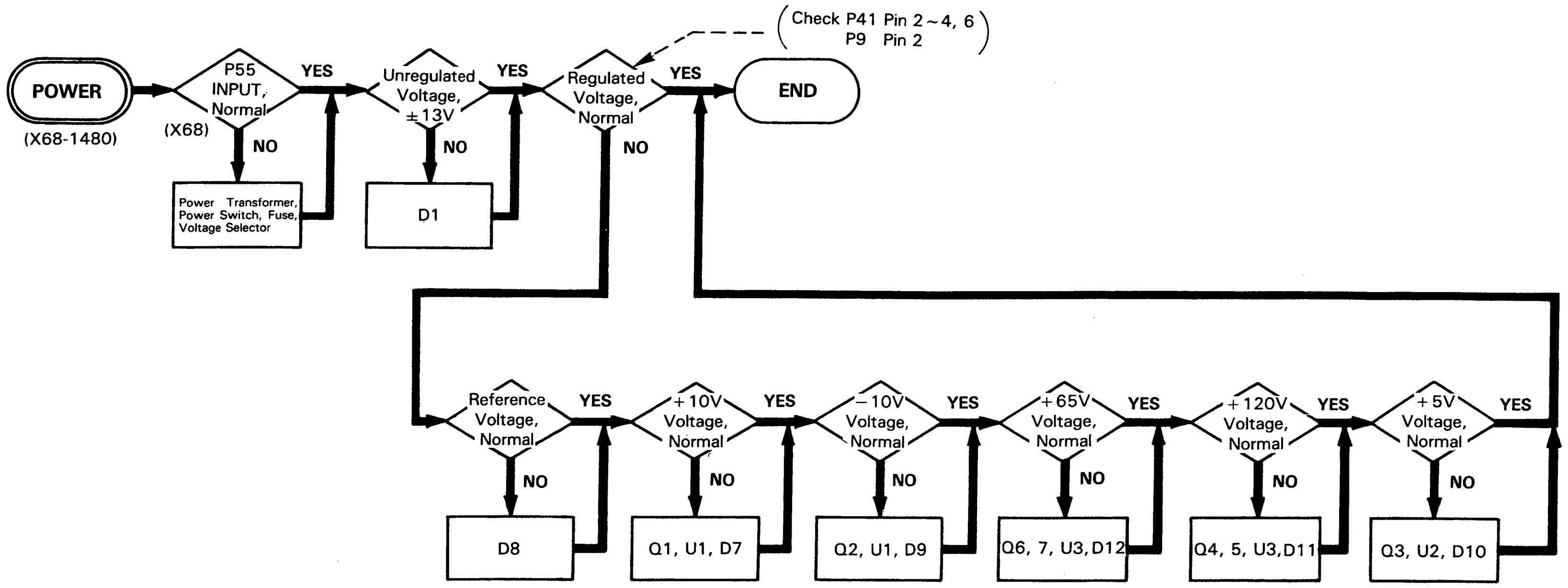

PATTERN SIDE
20ns Range Sweep Time
Leading Edge
Sampling Horizontal Position Center
VR401
VR403
VR404
X Position Center
10ms Range Sweep Time
VR202
VR101
1ms Range Sweep Time
VR201
TC102
0.2μs Range Sweep Time
TC101
1μs Range Sweep Time
VR1
Trigger Level Center
FRONT

R/O UNIT (X77-1450-00)

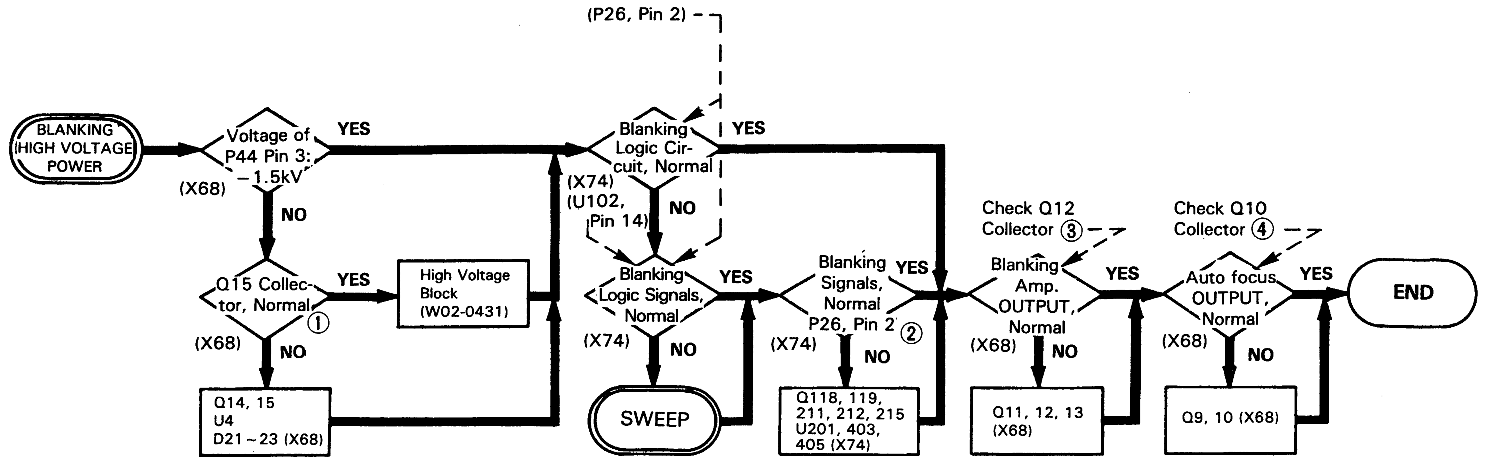

PATTERN SIDE
R/O Cursor Length
VR1
FRONT

TROUBLESHOOTING


START
Power LED goes on
YES
NO
POWER
P27 VOLTAGE
(X68)
YES
NO
P27, J27 (X74)
POWER LED
YES
NO
LED
X-Y spot appears on the screen
YES
NO
(Check INTENSITY, ▲▼Position, ◄► Position)
POWER
BLANKING HIGH VOLTAGE POWER
▲▼Position
YES
NO
V.AMP
◄►Position
YES
NO
H.AMP
MODE: CH1, CH2
INPUT: GND
TRIGGERING MODE: AUTO
Sweep Operating, Normal
YES
NO
SWEEP
Vertical Axis Operating, Normal
YES
NO
V.AMP
Triggering, Normal
YES
NO
TRIG
Scale Illumination
YES
NO
Q8 (X68)
PL1, 2, 3
Trace Rotation
YES
NO
Q17, 18 (X68)
Trace Rotation Coil
Calibration Voltage
YES
NO
U2
D26, 27
(X68)
END

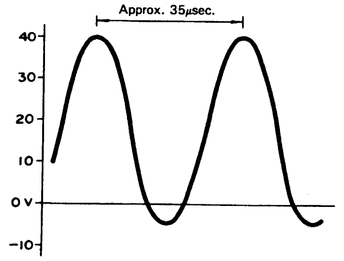

POWER
(X68-1480)
P55 INPUT, Normal
(X68)
YES
NO
Power Transformer, Power Switch, Fuse, Voltage Selector
Unregulated Voltage, ±13V
YES
NO
D1
Regulated Voltage, Normal
YES
NO
(Check P41 Pin 2~4, 6
P9 Pin 2)
END
Reference Voltage, Normal
YES
NO
D8
+10V Voltage, Normal
YES
NO
Q1, U1, D7
−10V Voltage, Normal
YES
NO
Q2, U1, D9
+65V Voltage, Normal
YES
NO
Q6, 7, U3, D12
+120V Voltage, Normal
YES
NO
Q4, 5, U3, D11
+5V Voltage, Normal
YES
NO
Q3, U2, D10

TROUBLESHOOTING

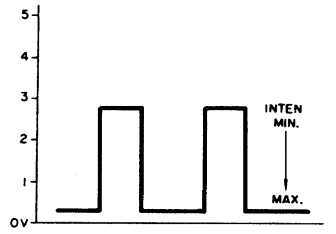

(P26, Pin 2)
BLANKING (HIGH VOLTAGE) POWER
Voltage of P44 Pin 3: −1.5kV
(X68)
YES
NO
Q15 Collector, Normal ①
(X68)
High Voltage Block (W02-0431)
Q14, 15
U4
D21～23 (X68)
Blanking Logic Circuit, Normal
(X74) (U102, Pin 14)
Blanking Logic Signals, Normal
(X74)
SWEEP
Blanking Signals, Normal P26, Pin 2 ②
(X74)
Q118, 119, 211, 212, 215 U201, 403, 405 (X74)
Check Q12 Collector ③
Blanking Amp. OUTPUT, Normal
(X68)
Q11, 12, 13 (X68)
Check Q10 Collector ④
Auto focus OUTPUT, Normal
(X68)
Q9, 10 (X68)
END

WAVEFORM OF CIRCUIT DIAGRAM

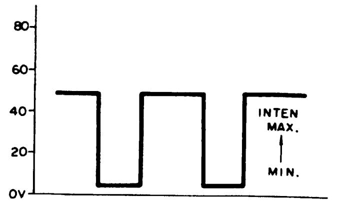
① (X68) Q15 Collector Waveform



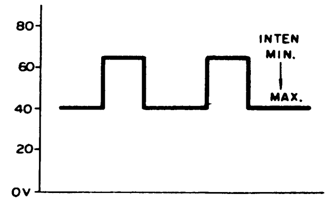
② (X74) P26, Pin 2 Waveform



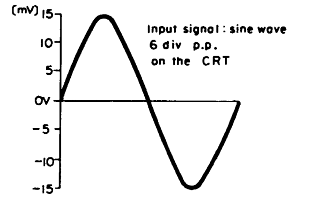
③ (X68) Q12 Collector Waveform



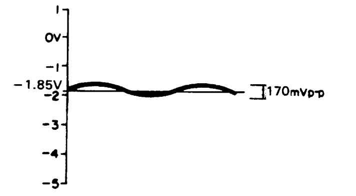
④ (X68) Q10 Collector Waveform



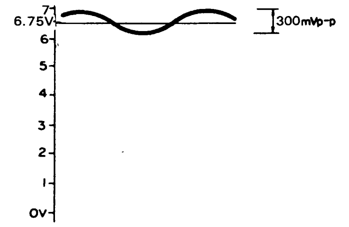
⑤ (X73) Q6a Base: CH1
Q106a Base: CH2 Waveform



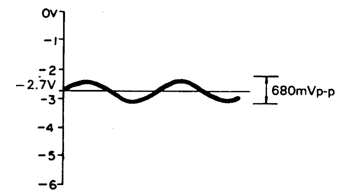
⑥ Q20, 21 Base: CH1
Q122, 123 Base: CH2 Waveform



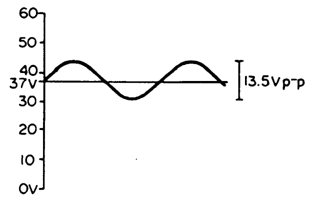
⑦ (X73) Q210, 211 Base Waveform

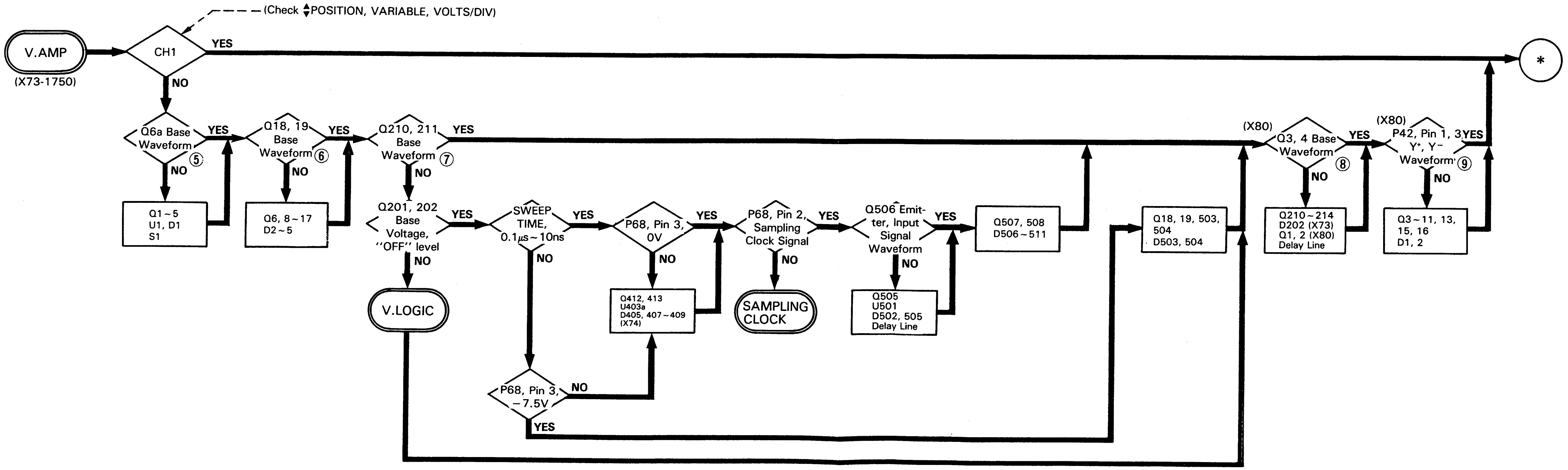


⑧ (X80) Q3, 4 Base Waveform

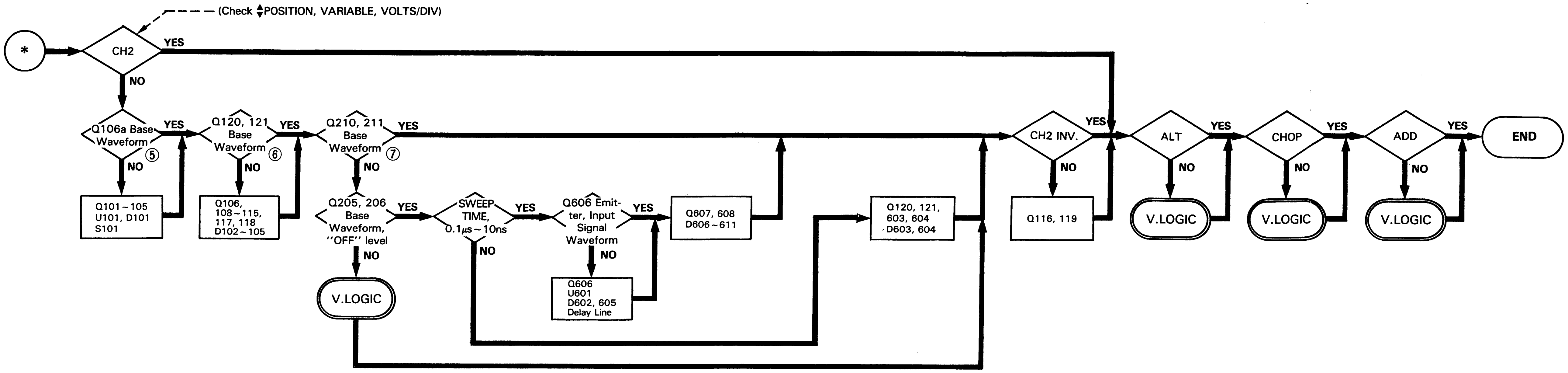


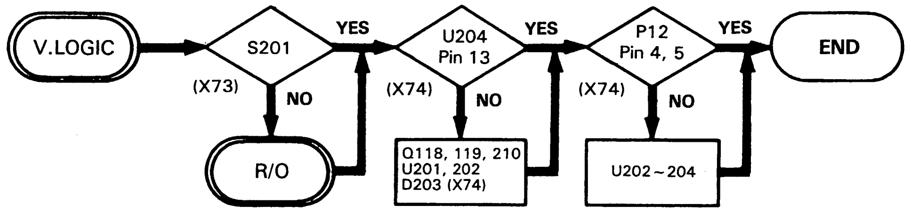
⑨ (X80) P42, Pin 1, 3 Waveform

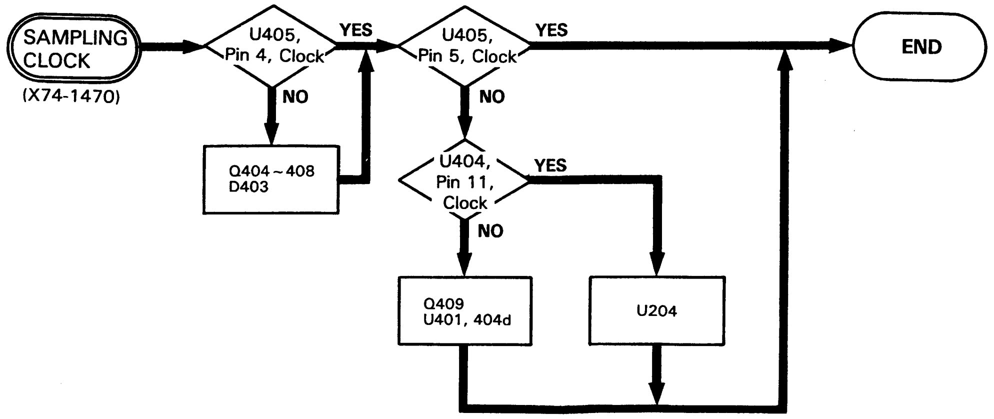



(Check ⇕POSITION, VARIABLE, VOLTS/DIV)
V.AMP
(X73-1750)
CH1
YES
NO
Q6a Base Waveform ⑤
Q1～5
U1, D1
S1
Q18, 19 Base Waveform ⑥
Q6, 8～17
D2～5
Q210, 211 Base Waveform ⑦
Q201, 202 Base Voltage, "OFF" level
V.LOGIC
SWEEP TIME, 0.1μs～10ns
P68, Pin 3, −7.5V
P68, Pin 3, 0V
Q412, 413
U403a
D405, 407～409
(X74)
P68, Pin 2, Sampling Clock Signal
SAMPLING CLOCK
Q506 Emitter, Input Signal Waveform
Q505
U501
D502, 505
Delay Line
Q507, 508
D506～511
Q18, 19, 503, 504
D503, 504
(X80)
Q3, 4 Base Waveform ⑧
Q210～214
D202 (X73)
Q1, 2 (X80)
Delay Line
(X80)
P42, Pin 1, 3 Y⁺, Y⁻ Waveform ⑨
Q3～11, 13, 15, 16
D1, 2
*

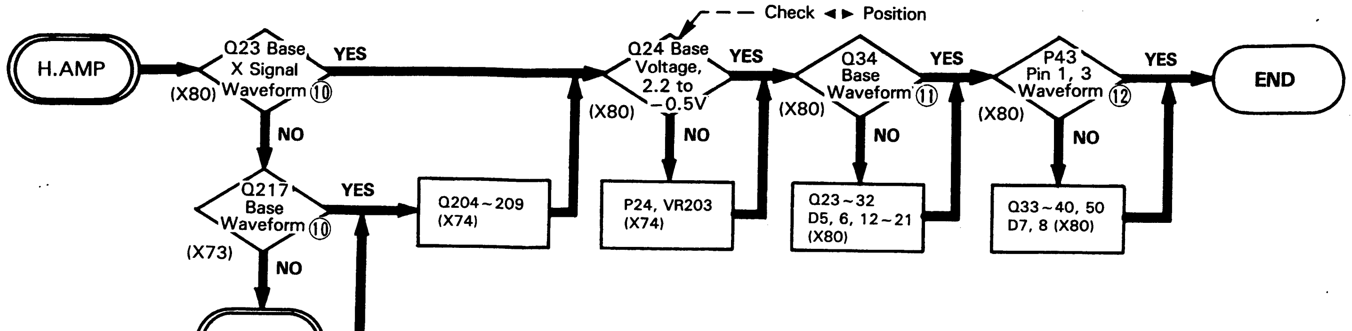
TROUBLESHOOTING


(Check ⇕POSITION, VARIABLE, VOLTS/DIV)
*
CH2
YES
NO
Q106a Base Waveform ⑤
Q101~105
U101, D101
S101
Q120, 121 Base Waveform ⑥
Q106,
108~115,
117, 118
D102~105
Q210, 211 Base Waveform ⑦
Q205, 206 Base Waveform, "OFF" level
V.LOGIC
SWEEP TIME, 0.1μs~10ns
Q606 Emitter, Input Signal Waveform
Q606
U601
D602, 605
Delay Line
Q607, 608
D606~611
Q120, 121,
603, 604
D603, 604
CH2 INV.
Q116, 119
ALT
CHOP
ADD
V.LOGIC
V.LOGIC
V.LOGIC
END


V.LOGIC
S201
(X73)
YES
NO
R/O
U204
Pin 13
(X74)
Q118, 119, 210
U201, 202
D203 (X74)
P12
Pin 4, 5
(X74)
U202~204
END

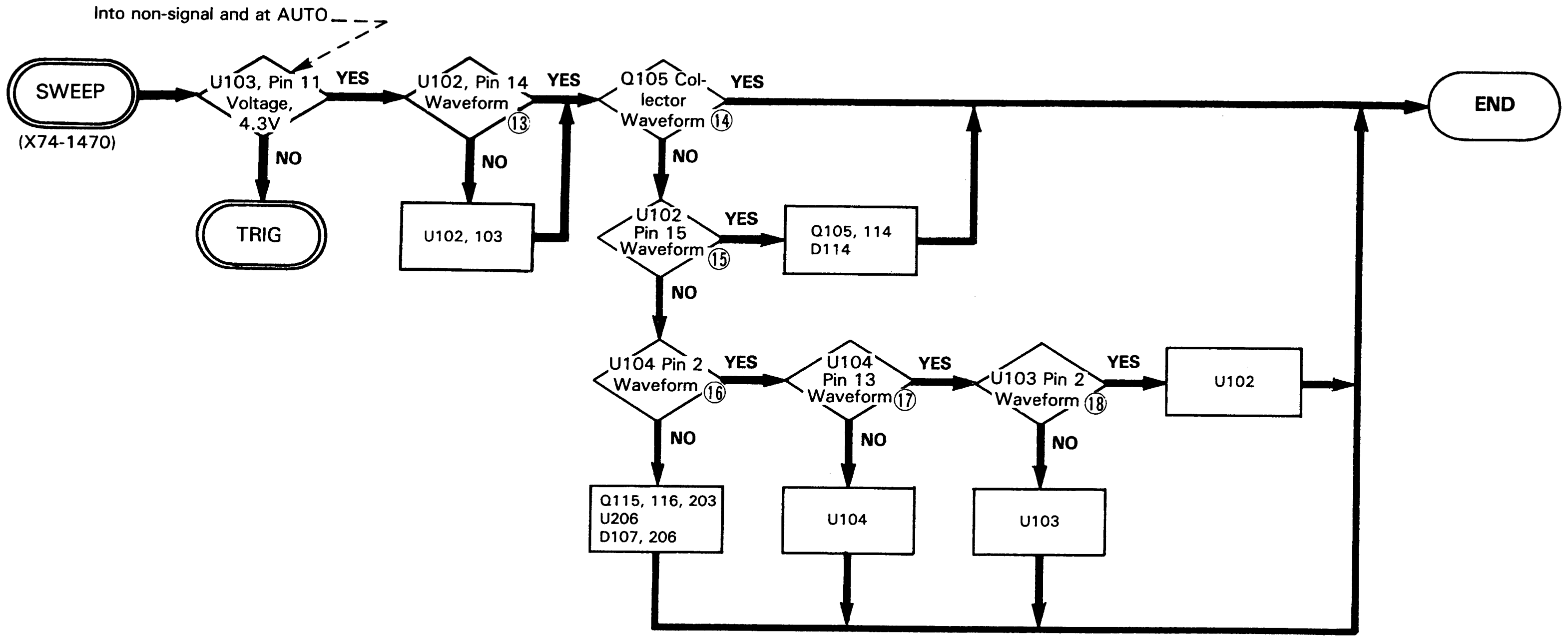

SAMPLING CLOCK
(X74-1470)
U405,
Pin 4, Clock
YES
NO
Q404~408
D403
U405,
Pin 5, Clock
U404,
Pin 11,
Clock
Q409
U401, 404d
U204
END

TROUBLESHOOTING



Check ◄► Position
H.AMP
Q23 Base X Signal Waveform ⑩
(X80)
YES
NO
Q217 Base Waveform ⑩
(X73)
YES
NO
V.AMP
Q204～209 (X74)
Q24 Base Voltage, 2.2 to −0.5V
(X80)
YES
NO
P24, VR203 (X74)
Q34 Base Waveform ⑪
(X80)
YES
NO
Q23～32 D5, 6, 12～21 (X80)
P43 Pin 1, 3 Waveform ⑫
(X80)
YES
NO
Q33～40, 50 D7, 8 (X80)
END

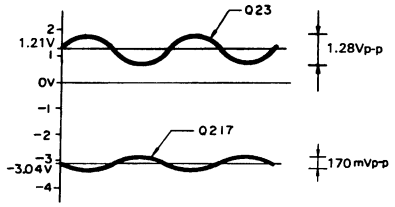
* **Condition**
Apply a sine wave signal to X input for 6 div horizontal amplitude.



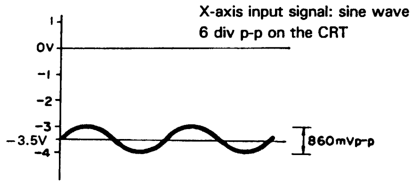
Into non-signal and at AUTO
SWEEP
(X74-1470)
U103, Pin 11 Voltage, 4.3V
YES
NO
TRIG
U102, Pin 14 Waveform ⑬
YES
NO
U102, 103
Q105 Collector Waveform ⑭
YES
NO
U102 Pin 15 Waveform ⑮
YES
NO
Q105, 114 D114
U104 Pin 2 Waveform ⑯
YES
NO
Q115, 116, 203 U206 D107, 206
U104 Pin 13 Waveform ⑰
YES
NO
U104
U103 Pin 2 Waveform ⑱
YES
NO
U103
U102
END

WAVEFORM OF CIRCUIT DIAGRAM

⑩ **(X80) Q23, Base**
Q217, Base Waveform

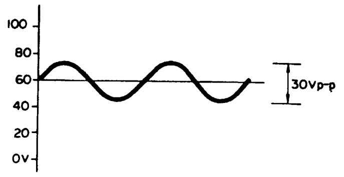


⑪ **(X80) Q34, Base Waveform**

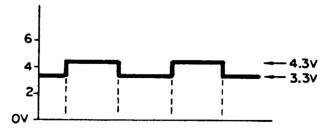


X-axis input signal: sine wave
6 div p-p on the CRT

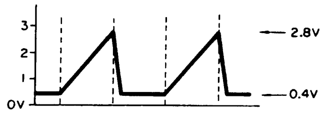
⑫ **(X80) P43, Pin 1, 3 Waveform**



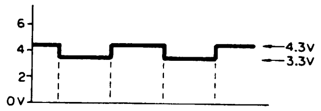
⑬ **(X74) U102, Pin 14 Waveform**



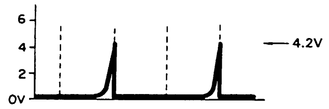
⑭ **(X74) Q105, Collector Waveform**



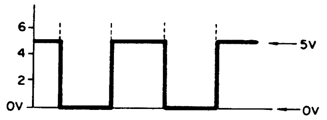
⑮ **(X74) U102, Pin 15 Waveform**



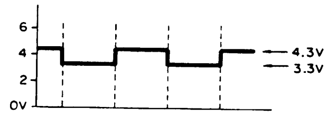
⑯ **(X74) U104, Pin 2 Waveform**

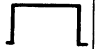
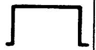
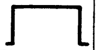
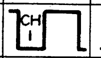
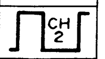
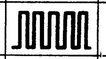
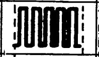
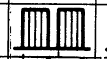
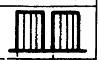
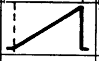
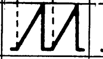
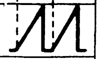
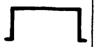


⑰ **(X74) U104, Pin 13 Waveform**

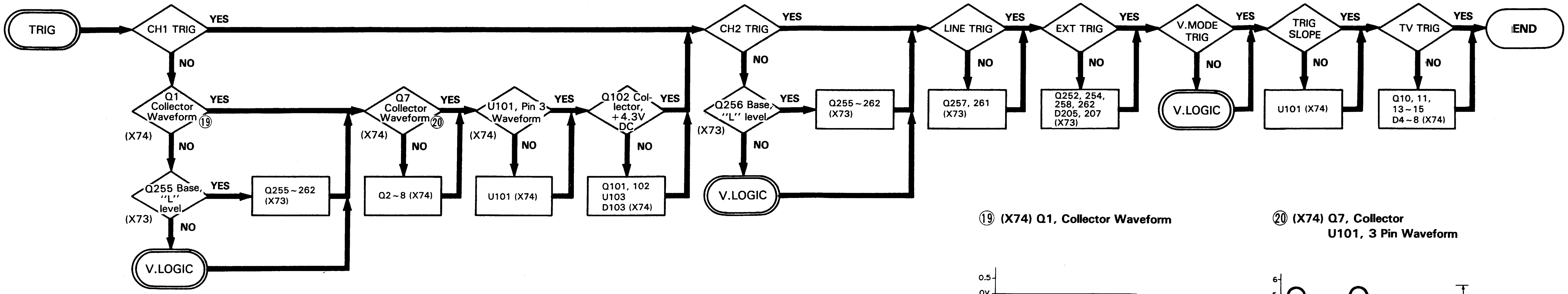


⑱ **(X74) U103, Pin 2 Waveform**

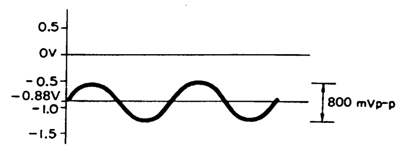


	P12 (X74)	U204 (X74)		U202 (X74)	U201 (X74)	CH. Switch Signal P12 (X73)	
	Pin 1 $\overline{\text{CHOP}}$	Pin 10 $\overline{\text{PR}}$	Pin 14 $\overline{\text{CLR}}$	Pin 11	Pin 6	Pin 1 $\overline{\text{CH1-E}}$	Pin 2 $\overline{\text{CH2-E}}$
CH1	H	H	L	H		L	H
CH2	H	L	H	H		H	L
ALT	H	H	H	H			
CHOP	L	H	H				
							
ADD	H	L	L	H		L	L
X-Y	—	—	L	H	—	L	H

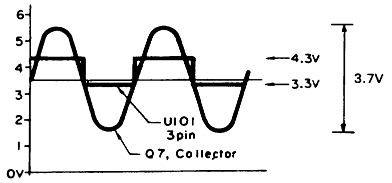
TROUBLESHOOTING


TRIG
CH1 TRIG
YES
NO
Q1 Collector Waveform ⑲
(X74)
YES
NO
Q255 Base, "L" level
(X73)
YES
NO
Q255~262 (X73)
V.LOGIC
Q7 Collector Waveform ⑳
(X74)
YES
NO
Q2~8 (X74)
U101, Pin 3 Waveform
(X74)
YES
NO
U101 (X74)
Q102 Collector, +4.3V DC
YES
NO
Q101, 102
U103
D103 (X74)
CH2 TRIG
YES
NO
Q256 Base, "L" level
(X73)
YES
NO
Q255~262 (X73)
V.LOGIC
LINE TRIG
YES
NO
Q257, 261 (X73)
EXT TRIG
YES
NO
Q252, 254, 258, 262
D205, 207
(X73)
V.MODE TRIG
YES
NO
V.LOGIC
TRIG SLOPE
YES
NO
U101 (X74)
TV TRIG
YES
NO
Q10, 11, 13~15
D4~8 (X74)
END

⑲ (X74) Q1, Collector Waveform

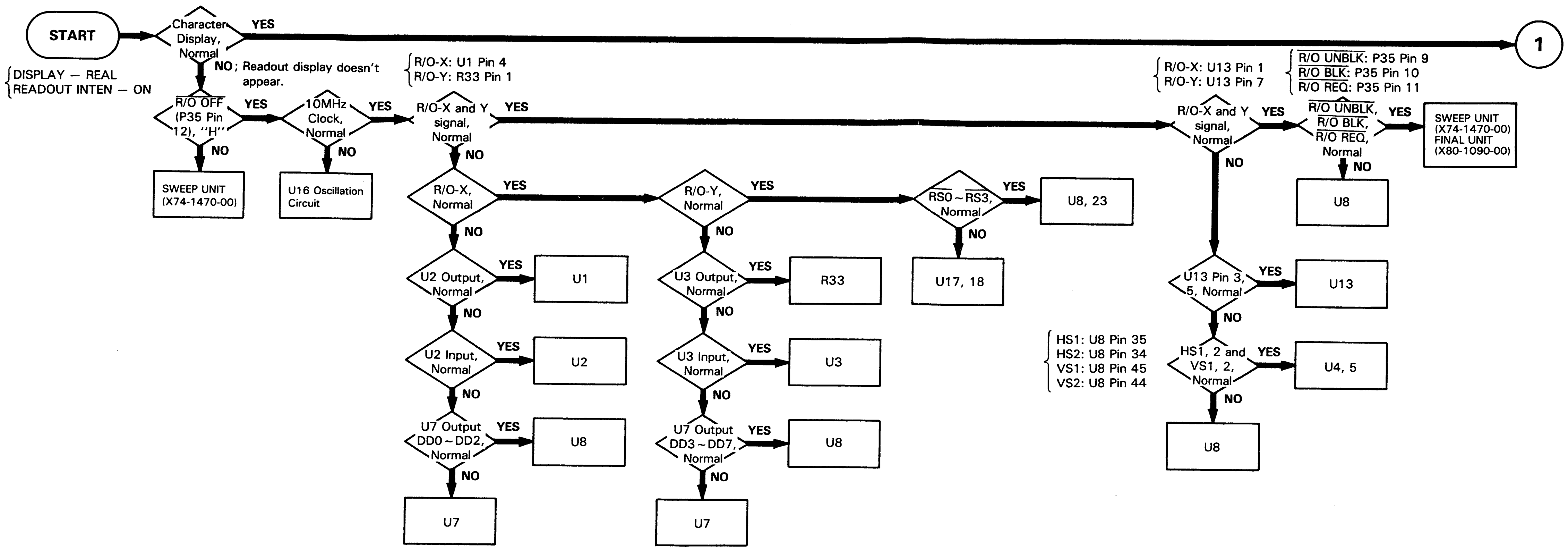


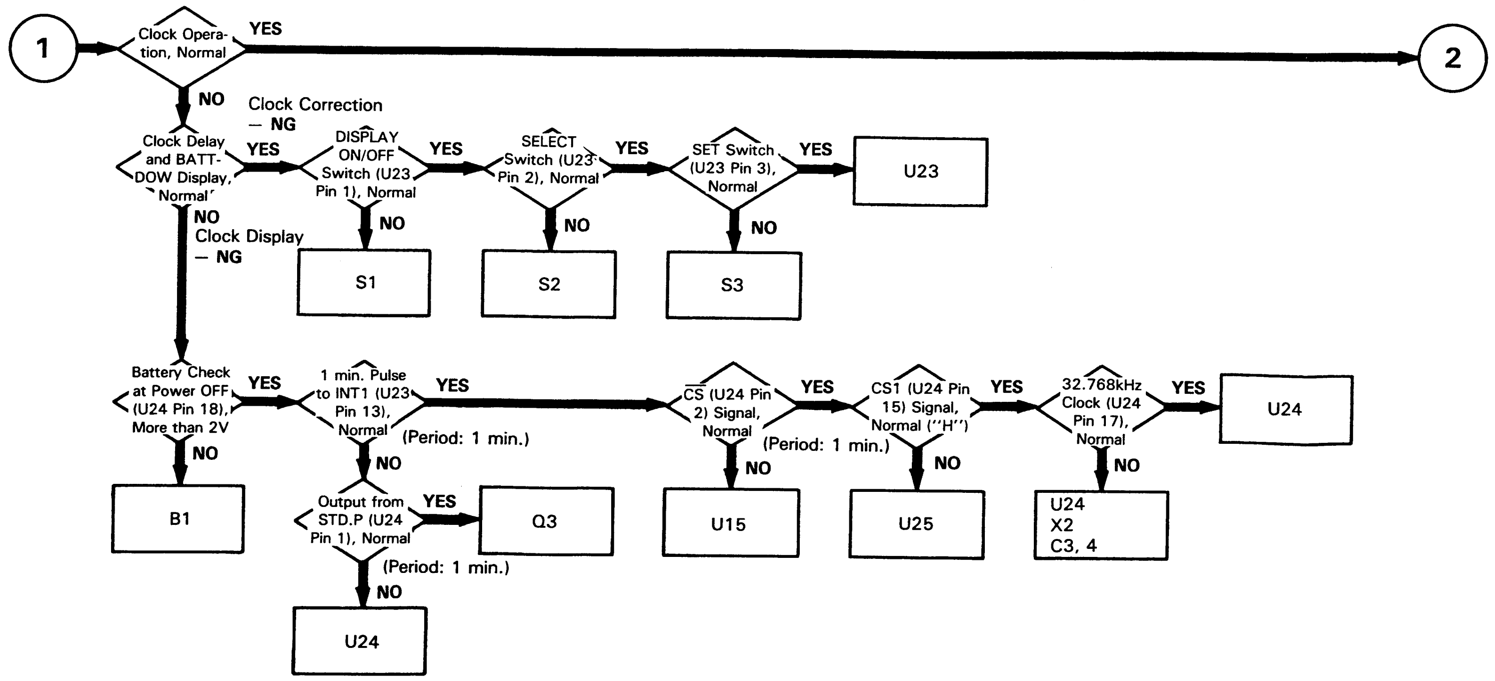
⑳ (X74) Q7, Collector
U101, 3 Pin Waveform



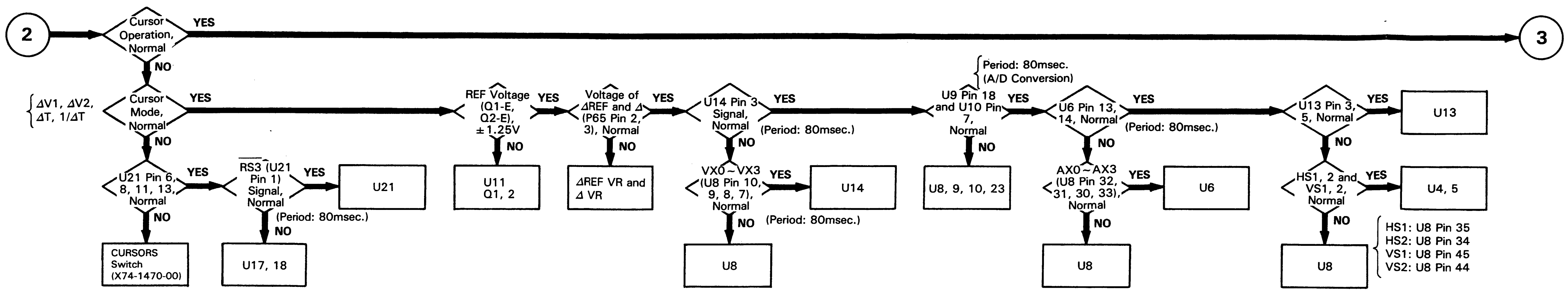
TROUBLESHOOTING

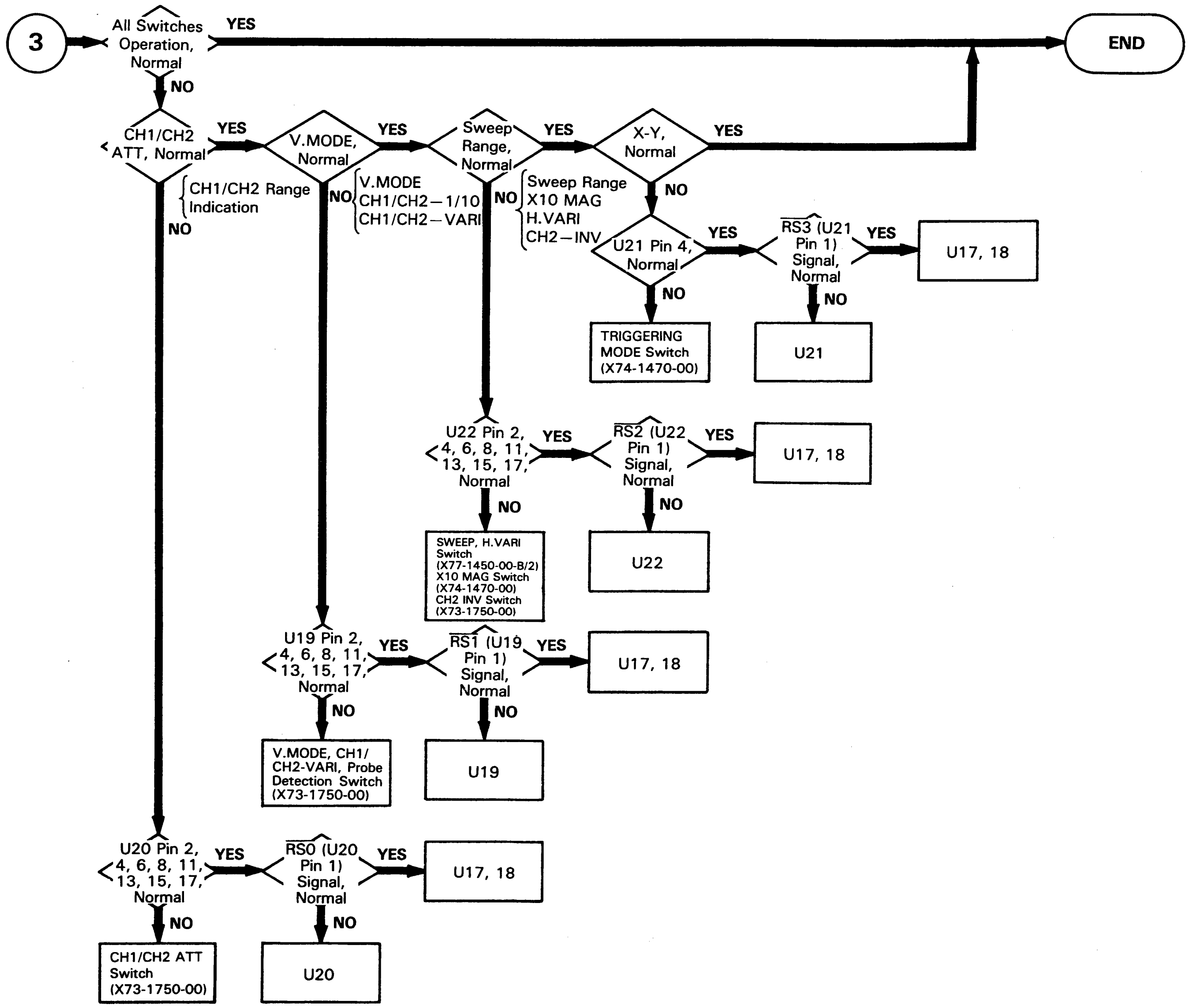
READOUT SECTION TROUBLESHOOTING
R/O UNIT (X77-1450-00)


START
Character Display, Normal
YES
NO; Readout display doesn't appear.
DISPLAY — REAL
READOUT INTEN — ON
R/O OFF (P35 Pin 12), "H"
YES
NO
SWEEP UNIT (X74-1470-00)
10MHz Clock, Normal
YES
NO
U16 Oscillation Circuit
R/O-X: U1 Pin 4
R/O-Y: R33 Pin 1
R/O-X and Y signal, Normal
YES
NO
R/O-X, Normal
YES
NO
U2 Output, Normal
YES
U1
NO
U2 Input, Normal
YES
U2
NO
U7 Output DD0 ~ DD2, Normal
YES
U8
NO
U7
R/O-Y, Normal
YES
NO
U3 Output, Normal
YES
R33
NO
U3 Input, Normal
YES
U3
NO
U7 Output DD3 ~ DD7, Normal
YES
U8
NO
U7
$\overline{RS0} \sim \overline{RS3}$, Normal
YES
U8, 23
NO
U17, 18
R/O-X: U13 Pin 1
R/O-Y: U13 Pin 7
R/O-X and Y signal, Normal
YES
NO
U13 Pin 3, 5, Normal
YES
U13
NO
HS1: U8 Pin 35
HS2: U8 Pin 34
VS1: U8 Pin 45
VS2: U8 Pin 44
HS1, 2 and VS1, 2, Normal
YES
U4, 5
NO
U8
$\overline{R/O\ UNBLK}$: P35 Pin 9
$\overline{R/O\ BLK}$: P35 Pin 10
$\overline{R/O\ REQ}$: P35 Pin 11
$\overline{R/O\ UNBLK}$, $\overline{R/O\ BLK}$, $\overline{R/O\ REQ}$, Normal
YES
SWEEP UNIT (X74-1470-00) FINAL UNIT (X80-1090-00)
NO
U8
1


1
Clock Operation, Normal
YES
2
NO
Clock Correction — NG
Clock Delay and BATT-DOW Display, Normal
YES
DISPLAY ON/OFF Switch (U23 Pin 1), Normal
YES
NO
S1
SELECT Switch (U23 Pin 2), Normal
YES
NO
S2
SET Switch (U23 Pin 3), Normal
YES
U23
NO
S3
NO
Clock Display — NG
Battery Check at Power OFF (U24 Pin 18), More than 2V
YES
NO
B1
1 min. Pulse to INT1 (U23 Pin 13), Normal
(Period: 1 min.)
YES
NO
Output from STD.P (U24 Pin 1), Normal
YES
Q3
(Period: 1 min.)
NO
U24
$\overline{CS}$ (U24 Pin 2) Signal, Normal
(Period: 1 min.)
YES
NO
U15
CS1 (U24 Pin 15) Signal, Normal ("H")
YES
NO
U25
32.768kHz Clock (U24 Pin 17), Normal
YES
U24
NO
U24
X2
C3, 4

TROUBLESHOOTING


2
Cursor Operation, Normal
YES
NO
3
ΔV1, ΔV2, ΔT, 1/ΔT
Cursor Mode, Normal
U21 Pin 6, 8, 11, 13, Normal
RS3 (U21 Pin 1) Signal, Normal
(Period: 80msec.)
U21
U17, 18
CURSORS Switch (X74-1470-00)
REF Voltage (Q1-E, Q2-E), ±1.25V
U11 Q1, 2
Voltage of ΔREF and Δ (P65 Pin 2, 3), Normal
ΔREF VR and Δ VR
U14 Pin 3 Signal, Normal
(Period: 80msec.)
VX0~VX3 (U8 Pin 10, 9, 8, 7), Normal
U14
(Period: 80msec.)
U8
Period: 80msec. (A/D Conversion)
U9 Pin 18 and U10 Pin 7, Normal
U8, 9, 10, 23
U6 Pin 13, 14, Normal
(Period: 80msec.)
AX0~AX3 (U8 Pin 32, 31, 30, 33), Normal
U6
U8
U13 Pin 3, 5, Normal
U13
HS1, 2 and VS1, 2, Normal
U4, 5
U8
HS1: U8 Pin 35
HS2: U8 Pin 34
VS1: U8 Pin 45
VS2: U8 Pin 44


3
All Switches Operation, Normal
YES
NO
END
CH1/CH2 ATT, Normal
CH1/CH2 Range Indication
V.MODE, Normal
V.MODE CH1/CH2−1/10 CH1/CH2−VARI
Sweep Range, Normal
Sweep Range X10 MAG H.VARI CH2−INV
X-Y, Normal
U21 Pin 4, Normal
RS3 (U21 Pin 1) Signal, Normal
U17, 18
TRIGGERING MODE Switch (X74-1470-00)
U21
U22 Pin 2, 4, 6, 8, 11, 13, 15, 17, Normal
RS2 (U22 Pin 1) Signal, Normal
U17, 18
SWEEP, H.VARI Switch (X77-1450-00-B/2) X10 MAG Switch (X74-1470-00) CH2 INV Switch (X73-1750-00)
U22
U19 Pin 2, 4, 6, 8, 11, 13, 15, 17, Normal
RS1 (U19 Pin 1) Signal, Normal
U17, 18
V.MODE, CH1/CH2-VARI, Probe Detection Switch (X73-1750-00)
U19
U20 Pin 2, 4, 6, 8, 11, 13, 15, 17, Normal
RS0 (U20 Pin 1) Signal, Normal
U17, 18
CH1/CH2 ATT Switch (X73-1750-00)
U20

TROUBLESHOOTING

READOUT SIGNAL TABLE

(1) CH1 (CH2) Vertical Attenuator

VOLTS/DIV	U20 Pin 13 (17) "ATT3"	U20 Pin 6 (2) "ATT2"	U20 Pin 11 (15) "ATT1"	U20 Pin 8 (4) "ATT0"	Display	
1 mV	I	I	I	I	CH1 (CH2)	1 mV
2 mV	I	I	I	O	CH1 (CH2)	2 mV
5 mV	I	I	O	I	CH1 (CH2)	5 mV
10 mV	I	I	O	O	CH1 (CH2)	10 mV
20 mV	I	O	I	I	CH1 (CH2)	20 mV
50 mV	I	O	I	O	CH1 (CH2)	50 mV
0.1 V	I	O	O	I	CH1 (CH2)	0.1 V
0.2 V	I	O	O	O	CH1 (CH2)	0.2 V
0.5 V	O	I	I	I	CH1 (CH2)	0.5 V
1 V	O	I	I	O	CH1 (CH2)	1 V
2 V	O	I	O	I	CH1 (CH2)	2 V
5 V	O	I	O	O	CH1 (CH2)	5 V

(2) CH1 (CH2) Vertical Gain VARIABLE

V. VARIABLE	U19 Pin 8 (11) "CH1 (CH2)/VARI"	Display
CAL	1	Space
UNCAL	0	>

(3) CH1 (CH2) Probe

Probe	U19 Pin 6 (13) "CH1 (CH2)/PROBE"	Display
1/1	1	VOLTS/DIV × 1 Indication
1/10	0	VOLTS/DIV × 10 Indication

(4) CH2 Polarity

Polarity (PULL INV)	U22 Pin 17 "CH2/INV"	Display
Normal	1	Space
Invert	0	↓

(5) Vertical MODE

MODE	U19 Pin 17 "V.MODE 3"	U19 Pin 2 "V.MODE 2"	U19 Pin 15 "V.MODE 1"	U19 Pin 4 "V.MODE 0"	Display	
CH1	1	1	1	1	CH1	
CH2	1	1	1	0		CH2
ALT	1	1	0	1	CH1	CH2
CHOP	1	0	1	1	CH1	CH2
ADD	0	1	1	1	CH1 +	CH2

(6) Sweep Range

SWEEP TIME/DIV	U22 Pin 4 "SWEEP 4"	U22 Pin 13 "SWEEP 3"	U22 Pin 6 "SWEEP 2"	U22 Pin 11 "SWEEP 1"	U22 Pin 8 "SWEEP 0"	Display
0.2 S	I	I	O	I	I	0.2 S
0.1 S	I	I	O	I	O	0.1 S
50 mS	I	I	O	O	I	50 mS
20 mS	I	I	O	O	O	20 mS
10 mS	I	O	I	I	I	10 mS
5 mS	I	O	I	I	O	5 mS
2 mS	I	O	I	O	I	2 mS
1 mS	I	O	I	O	O	1 mS
0.5 mS	I	O	O	I	I	0.5 mS
0.2 mS	I	O	O	I	O	0.2 mS
0.1 mS	I	O	O	O	I	0.1 mS
50 μS	I	O	O	O	O	50 μS
20 μS	O	I	I	I	I	20 μS
10 μS	O	I	I	I	O	10 μS
5 μS	O	I	I	O	I	5 μS
2 μS	O	I	I	O	O	2 μS
1 μS	O	I	O	I	I	1 μS
0.5 μS	O	I	O	I	O	0.5 μS
0.2 μS	O	I	O	O	I	0.2 μS
0.1 μS	O	I	O	O	O	0.1 μS
50 nS	O	O	I	I	I	50 nS
20 nS	O	O	I	I	O	20 nS
10 nS	O	O	I	O	I	10 nS

(7) Horizontal Magnification

Magnification (PULL ×10 MAG)	U22 Pin 15 "H-MAG"	Display
Normal	1	SWEEP TIME/DIV ×1 Indication
×10 MAG	0	SWEEP TIME/DIV ×1/10 Indication

(8) Sweep Time VARIABLE

H. VARIABLE	U22 Pin 2 "H-VARI"	Display
CAL	1	Space
UNCAL	0	>

(9) Horizontal MODE

H. MODE	U21 Pin 4 "X-Y"	Display
Sweep	1	Space
X-Y	0	X-Y

(10) Cursor MODE

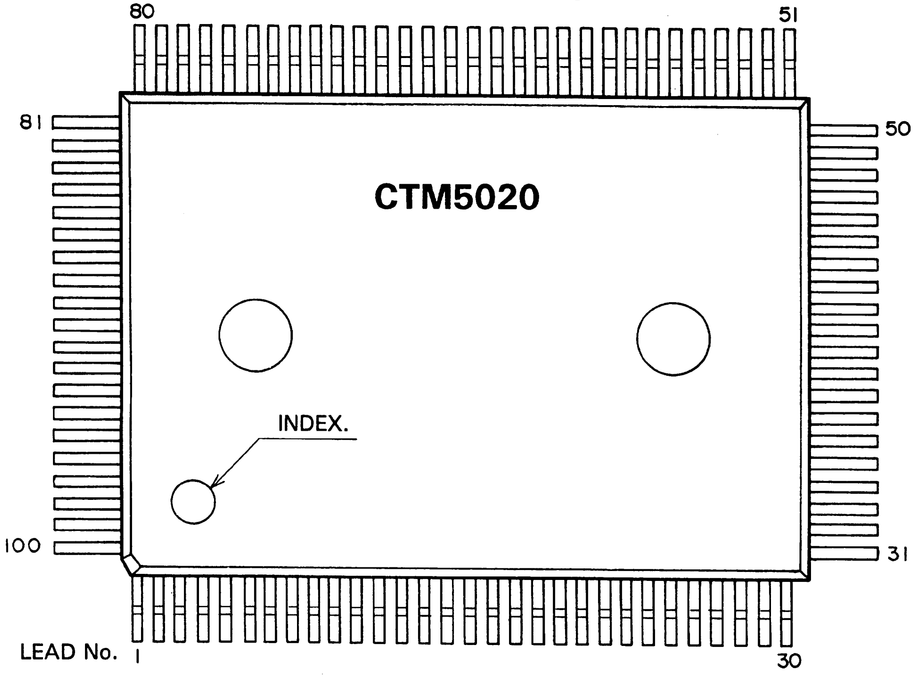
CURSORS	U21 Pin 13 "CURSOR-MODE 3"	U21 Pin 6 "CURSOR-MODE 2"	U21 Pin 11 "CURSOR-MODE 1"	U21 Pin 8 "CURSOR-MODE 0"	Display
OFF	1	1	1	1	No Cursor Line
ΔV1	I	I	I	O	Two Horizontal Cursor Lines
ΔV2	I	I	O	I	Two Horizontal Cursor Lines
ΔT	I	O	I	I	Two Vertical Cursor Lines
1/ΔT	O	I	I	I	Two Vertical Cursor Lines

(11) Calendar and Clock Display

DATE	Operation and Function
DISPLAY (ON/OFF)	1 : ON —— Display 0 : OFF —— Vanishment
SELECT	Selection of the corrected section (Year, Month, Day, O'clock and Minute)
SET	Correction of the calendar and clock display

TROUBLESHOOTING

CTM5020 PIN ASSIGNMENT (100-pin FPT) (with RAM)



CTM5020 PIN DESCRIPTION

Pin No.	I/O	Pin Name	Function
1	I	CONT	Selection between $\overline{\text{X-Y}}$ mode and normal mode
2	I	A13	Address bus A13
3	–	VDD	+5 V power supply
4	I	A14	Address bus A14
5	I	A15	Address bus A15
6	O	INTO	1/2 period of ROSF signal
7	O	VX3	Selection signal of analog switch to input the cursor VR voltage
8	O	VX2	Selection signal of analog switch to input the cursor VR voltage
9	O	VX1	Selection signal of analog switch to input the cursor VR voltage
10	O	VX0	Selection signal of analog switch to input the cursor VR voltage
11	O	DA0	Outport (8004H) D0 D/A data (LSB)
12	O	DA1	Outport (8004H) D1 D/A data
13	O	DA2	Outport (8004H) D2 D/A data
14	O	DA3	Outport (8004H) D3 D/A data
15	–	VSS	GND
16	O	DA4	Outport (8004H) D4 D/A data
17	O	DA5	Outport (8004H) D5 D/A data
18	O	DA6	Outport (8004H) D6 D/A data
19	O	DA7	Outport (8004H) D7 D/A data
20	O	DA8	Outport (8005H) D0 D/A data
21	O	DA9	Outport (8005H) D1 D/A data (MSB)
22	O	ROR	Readout monitor terminal
23	I	ROA	Readout monitor terminal
24	O	LEVX	Outport (8005H) D7
25	I	TCL	Test pin
26	I	TSD0	Test pin
27	I	TSD1	Test pin
28	–	VDD	+5 V power supply
29	I	TSD2	Test pin
30	O	AX2	Selection signal of analog switch to output the cursor voltage
31	O	AX1	Selection signal of analog switch to output the cursor voltage
32	O	AX0	Selection signal of analog switch to output the cursor voltage
33	O	AX3	Selection signal of analog switch to output the cursor voltage
34	O	HS2	Selection signal of analog switch for the readout X-axis signal
35	O	HS1	Selection signal of analog switch for the readout X-axis signal
36	O	TDIO	Test pin
37	I	TWE	Test pin
38	I	TCK1	Test pin
39	I	TST1	Test pin
40	–	VSS	GND
41	I	TST2	Test pin
42	I	TADD	Test pin

TROUBLESHOOTING

Pin No.	I/O	Pin Name	Function
43	I	TCK2	Test pin
44	O	VS2	Selection signal of analog switch for the readout Y-axis signal
45	O	VS1	Selection signal of analog switch for the readout Y-axis signal
46	O	VA0	Character Y-axis DAC data
47	O	VA4	Character Y-axis DAC data
48	O	VA3	Character Y-axis DAC data
49	O	VA2	Character Y-axis DAC data
50	O	VA1	Character Y-axis DAC data
51	O	GETD	Character X-axis data latch clock
52	O	CA0	Character counter data
53	–	VDD	+5 V power supply
54	O	CA4	Character counter data
55	O	CA3	Character counter data
56	O	CA2	Character counter data
57	O	CA1	Character counter data
58	O	CD3	Character ROM address
59	O	CD2	Character ROM address
60	O	CD4	Character ROM address
61	O	CD1	Character ROM address
62	O	CD5	Character ROM address
63	O	DC4	Dot counter data
64	O	CD7	Character ROM address
65	–	VSS	GND
66	O	DC3	Dot counter data
67	O	DC2	Dot counter data
68	O	CD6	Character ROM address
69	O	DC1	Dot counter data
70	O	DC0	Dot counter data
71	O	CD0	Character ROM address
72	I	DD7	Character ROM Y-axis DAC data
73	I	DD6	Character ROM Y-axis DAC data
74	I	DD5	Character ROM Y-axis DAC data
75	I	DD4	Character ROM Y-axis DAC data
76	I	DD3	Character ROM Y-axis DAC data
77	I	SING	Terminal for $\overline{\text{SINGLE}}$ signal
78	–	VDD	+5 V power supply
79	I	R10M	10 MHz clock
80	I	10M	10 MHz clock
81	I	HLDF	Holdoff input
82	I	SGA	Sweep gate
83	I	ROSP	Readout off
84	I	ROD	Character counter reset
85	O	HLDL	Holdoff output
86	O	ROUB	Readout unblanking
87	O	ROB	Readout blanking
88	O	ROQ	Readout request
89	O	ROED	Readout end
90	–	VSS	GND
91	I	D7	Data bus D7
92	I	D5	Data bus D5
93	I	D3	Data bus D3
94	I	D1	Data bus D1
95	I	ALE	Address/Data latch
96	I	D6	Data bus D6
97	I	D4	Data bus D4
98	I	D2	Data bus D2
99	I	D0	Data bus D0
100	I	WR	Write timing signal

PARTS LIST

CS-5140 UNIT

Y70-1580-61

REF.NO	PARTS NO	NAME & DESCRIPTION
	B41-0710-04	CAUTION LABEL (HIGH VOLTAGE)
	B50-7622-00	INSTRUCTION MANUAL
	E31-0717-05	WIRE ASS'Y (POWER,GND P71)
	E31-2808-15	WIRE ASS'Y (EXT-IN P3)
	E31-2836-05	WIRE ASS'Y (X-VARI. P37)
	E31-2837-05	WIRE ASS'Y (SWEEP CODE P38)
	E31-2848-05	WIRE ASS'Y (Z-IN P54)
	E31-2858-05	WIRE ASS'Y (CURSOR V.R. P65)
	E31-2860-05	WIRE ASS'Y (SAMPLE CLOCK P68)
	E31-2861-05	WIRE ASS'Y (INLET-FILTER P69)
	E31-2901-05	LEAD WIRE WITH HARNESSES (D)
	F05-1224-05	FUSE 1.2A(6X30MM) FOR 100-120V
	F05-8013-05	FUSE 0.8A(5X20MM) FOR 220-240V
	F05-8015-05	FUSE 0.8A(6X30MM) FOR 220-240V
	H01-5879-14	CARTON BOX
	H10-2828-12	FOAMED STYRENE PAD (FRONT)
	H10-2829-12	FOAMED STYRENE PAD (REAR)
	H12-0564-04	PAD
	H20-1719-04	VINYL COVER
	H25-0029-04	POLYETHYLENE BAG (FUSE)
	J61-0408-05	WIRE WRAPPING BAND
	J61-0509-05	WIRE WRAPPING BAND
	N08-0611-04	SCREW (FOR CORD WRAP)
	N09-0623-04	SCREW, SEMS M3X8
	N09-0705-05	SCREW, HEX SOCKET FLAT HD M4X8
	N09-0739-05	SCREW, SEMS TAP TITE M3X8
	N09-0744-04	SCREW, SEMS M3X12
	N10-2030-41	NUT, HEX
	N17-1030-46	TOOTHED LOCK WASHER FOR M3
	N30-3012-41	SCREW, PAN HD M3X12
	N30-4008-41	SCREW, PAN HD M4X8
	N32-3006-41	SCREW, FLAT HD M3X6
	N32-3008-41	SCREW, FLAT HD M3X8
	N34-3012-41	SCREW, TRUSS M3X12
	N88-3008-41	SCREW, FLAT HD TAP TITE M3X8
	RD14BB2E220J	RES. CARBON 22 5% 1/4W
	212-3017-05	TUBE (PLASTIC)
1	A01-1179-02	CASE (TOP)
2	A01-1180-12	CASE (BOTTOM)
3	A13-0914-02	FRAME (L)
4	A13-0915-12	FRAME (CENTER)
5	A13-0916-02	FRAME (R.UPPER)
6	A13-0917-02	FRAME (R.LOWER)
7	A20-2822-11	MOLDED PANEL
8	A21-1124-13	DECORATIVE PANEL
9	A22-0854-02	SUB PANEL
10	A23-1676-02	REAR PANEL
11	B07-0716-03	FILTER FRAME
12	B19-0749-04	FILTER
13	B30-0951-25	SCALE ILLUMI LAMP ASS'Y
14	B40-2765-04	NAME PLATE (SERIAL NO)
15	B40-2899-13	NAME PLATE (MODEL)
16	B41-0797-14	CAUTION LABEL
17	D21-0915-04	EXTENSION SHAFT
18	D22-0501-04	JOINT & COUPLING
19	E04-0259-05	BNC RECEPTACLE
20	E04-0260-05	BNC RECEPTACLE (READOUT)
21A	E18-0365-05	AC SELECTOR FOR 6X30MM FUSE
21B	E18-0366-05	AC SELECTOR FOR 5X20MM FUSE
22	E21-0660-04	TERMINAL(CAL)
23	E21-0667-05	METAL TERMINAL
24	E23-0513-05	SOLDER LUG (BNC)
25	E23-0552-04	EARTH TERMINAL
26A	E30-1818-05	JIS POWER CORD
26B	E30-1819-05	CEE POWER CORD
26C	E30-1820-05	UL/CSA POWER CORD
26D	E30-1821-05	SAA POWER CORD
26E	E30-1644-15	BS POWER CORD
27	F07-0936-04	HANDLE COVER
28	F09-0512-04	EDGING
29	F10-1602-03	SCREENING PLATE
30	F11-1206-03	CRT SHIELD
31	F15-0733-04	FELT
32	F20-0658-04	INSULATION SHEET
33	F20-0667-04	INSULATION SHEET
34	F20-0668-14	INSULATION PLATE
35	G01-0909-04	COIL SPRING (CAL SHIELD)
36	G02-0606-14	SPRING FOR HANDLE
37	J02-0089-05	RUBBER LEG
38	J10-0418-02	BEZEL
39	J19-1651-04	BLACKET
40	J19-1652-04	BLACKET FOR P.C.B.
41	J21-2906-05	GEAR FOR HANDLE
42	J21-2907-05	RING FOR HANDLE
43	J21-4594-03	BRACKET FOR CRT
44	J30-0621-04	SPACER
45	J42-0533-04	BUSHING (FREE)
46	J59-0403-05	NYLON RIVET
47	J61-0516-05	SUPPORT (T TYPE)
48	K01-0524-15	HANDLE
49	K21-0892-03	KNOB (VOLTS/DIV)
50	K21-0893-03	KNOB (SWEEP TIME/DIV)
51	K21-0894-04	KNOB (VARIABLE)
52	K23-0808-03	KNOB
53	K23-0809-03	KNOB
54	K27-0537-04	KNOB (FOR LEVER SWITCH)
55	K27-0538-04	KNOB (FOR PUSH SWITCH)
56	L01-9695-05	POWER TRANSFORMER
57	L39-0526-15	ROTATION COIL
58	L76-0112-05	DELAY LINE
59	N19-0710-05	WASHER
60	R29-1501-05	V.R. 1KB (CURSOR)
61	W01-0503-04	CORD WRAP
62	X68-1480-00	POWER SUPPLY UNIT
63	X73-1750-00	V.PRE UNIT
64	X74-1470-00	SWEEP UNIT
65	X77-1450-00	R/O UNIT
66	X80-1060-00	LINE FILTER UNIT
67	X80-1090-00	FINAL UNIT
68	150VTM31	CRT

POWER SUPPLY UNIT

X68-1480-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	F01-0813-05	HEAT SINK (CONVERTER)
	F01-0858-03	HEAT SINK (POWER TR)
	F10-1601-04	SHIELD PLATE
	F15-0727-04	HOLDER (NEON LAMP)
	J25-5182-22	P.C.B. (UNMOUNTED)
	N09-0623-04	SCREW, SEMS M3X8
	N09-0731-05	SCREW M3X12
	N14-0626-04	NUT
	W02-0431-05	HIGH VOLTAGE BLOCK
C001	C90-0970-05	CAP. ELECTRO 3900 25V
C002	C90-0970-05	CAP. ELECTRO 3900 25V
C003	CE04EW1C472M	CAP. ELECTRO 4700 20% 16V
C004	CE04W2E470M	CAP. ELECTRO 47 20% 250V
C005	C90-0969-05	CAP. ELECTRO 560 100V
C006	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C007	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C008	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C009	CE04EW1A221M	CAP. ELECTRO 220 20% 10V
C010	CE04W2C010M	CAP. ELECTRO 1 20% 160V
C011	CE04EW2A100M	CAP. ELECTRO 10 20% 100V
C012	C90-0978-05	CAP. ELECTRO 47 50V
C013	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C014	CK45FB2H472K	CAP. CERAMIC 4700P 10% 500V
C015	CC45FCH2H010C	CAP. CERAMIC 1P 0.25P 500V
C016	CC45FCH2H020C	CAP. CERAMIC 2P 0.25P 500V
C017	CE04W2C2R2M	CAP. ELECTRO 2.2 20% 160V
C018	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C019	CK45FB2H472K	CAP. CERAMIC 4700P 10% 500V
C020	CC45FCH2H010C	CAP. CERAMIC 1P 0.25P 500V
C021	CC45FCH2H010C	CAP. CERAMIC 1P 0.25P 500V
C022	C91-0571-05	CAP. CERAMIC 0.01 2KV
C023	C91-0571-05	CAP. CERAMIC 0.01 2KV
C024	CK45FB2H102K	CAP. CERAMIC 1000P 10% 500V
C025	C91-0571-05	CAP. CERAMIC 0.01 2KV
C026	CK45FB2H102K	CAP. CERAMIC 1000P 10% 500V
C027	C91-0571-05	CAP. CERAMIC 0.01 2KV
C028	C91-0571-05	CAP. CERAMIC 0.01 2KV
C029	C91-0571-05	CAP. CERAMIC 0.01 2KV
C030	C91-0571-05	CAP. CERAMIC 0.01 2KV
C031	CK45E3D102P	CAP. CERAMIC 1000P 2KV
C032	CQ92FM1H154K	CAP. MYLAR 0.15 10% 50V
C033	CQ92FM1H154K	CAP. MYLAR 0.15 10% 50V
C034	CC45FSL1H471J	CAP. CERAMIC 470P 5% 50V
C035	CK45FB1H472K	CAP. CERAMIC 4700P 10% 50V
C036	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C037	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C038	CC45FCH1H220J	CAP. CERAMIC 22P 5% 50V
C041	CQ92FM1H103J	CAP. MYLAR 0.01 5% 50V
C042	CE04W2C2R2M	CAP. ELECTRO 2.2 20% 160V
C043	CE04W2C2R2M	CAP. ELECTRO 2.2 20% 160V
C044	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C045	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C046	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C047	C91-0571-05	CAP. CERAMIC 0.01 2KV
C048	C91-0571-05	CAP. CERAMIC 0.01 2KV

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
C051	CE04EW1H101M	CAP. ELECTRO	100	20%	50V
C052	NO USE				
C053	CK45FB2H101K	CAP. CERAMIC	100P	10%	500V
C054	CK45FB2H472K	CAP. CERAMIC	4700P	10%	500V
C055	CK45FB2H472K	CAP. CERAMIC	4700P	10%	500V
C056	NO USE				
C057	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
D001	S4VB40F1	DIODE, BRIDGE			
D002	S2VB40F1	DIODE, BRIDGE			
D003	S1VB40	DIODE, BRIDGE			
D006	MTZ24JC	DIODE, ZENER	24V		
D007	MTZ10JC	DIODE, ZENER	10V		
D008	MTZ5.1JB	DIODE, ZENER	5.0V		
D009	MTZ10JC	DIODE, ZENER	10V		
D010	MTZ5.1JB	DIODE, ZENER	5.0V		
D011	1SS132	DIODE			
D012	1SS132	DIODE			
D013	1SS83	DIODE			
D014	1SS83	DIODE			
D015	1SR35-200	DIODE			
D016	1SR35-200	DIODE			
D017	1SS83	DIODE			
D018	1SS83	DIODE			
D019	1SR35-200	DIODE			
D020	1SR35-200	DIODE			
D021	1SS132	DIODE			
D022	1SS132	DIODE			
D023	1SS132	DIODE			
D024	1SS132	DIODE			
D025	1SS132	DIODE			
D026	1SS132	DIODE			
D027	1SS132	DIODE			
D028	1SS132	DIODE			
D029	1SS132	DIODE			
L001	L40-1011-13	FERRI INDUCTOR	100UH		
L002	L40-1011-13	FERRI INDUCTOR	100UH		
L003	L40-1021-03	FERRI INDUCTOR	1MH		
NL001	NE-2B	NEON LAMP			
NL002	NE-2B	NEON LAMP			
NL003	NE-2B	NEON LAMP			
NL004	NE-2B	NEON LAMP			
P009	E40-0673-05	PIN CONNECTOR	6P		
P026	E40-0273-05	PIN CONNECTOR	2P		
P027	E40-0473-05	PIN CONNECTOR	4P		
P041	E40-0673-05	PIN CONNECTOR	6P		
P044	E40-0503-05	PIN CONNECTOR	5P		
P045	NO USE				
P046	E40-0273-05	PIN CONNECTOR	2P		
P047	E40-0273-05	PIN CONNECTOR	2P		
P048	E40-0273-05	PIN CONNECTOR	2P		
P049	E40-0273-05	PIN CONNECTOR	2P		
P050	E40-0473-05	PIN CONNECTOR	4P		
P051	NO USE				
P052	E40-0473-05	PIN CONNECTOR	4P		
P053	NO USE				
P054	E40-0273-05	PIN CONNECTOR	2P		
P055	E40-1173-05	PIN CONNECTOR	11P		
Q001	2SB1133(S)	TR. SI, PNP			
Q002	2SD1666(S)	TR. SI, NPN			
Q003	2SB1133(S)	TR. SI, PNP			
Q004	2SC3749(N)	TR. SI, NPN			
Q005	2SC2271(D)	TR. SI, NPN			
Q006	2SC3749(N)	TR. SI, NPN			
Q007	2SC2271(D)	TR. SI, NPN			
Q008	2SD1666(S)	TR. SI, NPN			
Q009	2SA1208(S)	TR. SI, PNP			
Q010	2SC2910(S)	TR. SI, NPN			
Q011	2SA1210(S)	TR. SI, PNP			
Q012	2SC2912(S)	TR. SI, NPN			
Q013	2SA1005(K)	TR. SI, PNP			
Q014	2SA1175(F)	TR. SI, PNP			
Q015	2SD613(E)	TR. SI, NPN			
Q016	2SC2271(D)	TR. SI, NPN			
Q017	2SC1384(R)	TR. SI, NPN			
Q018	2SA684(R)	TR. SI, PNP			
R001	R92-1402-05	RES. SPR2L15	24	5%	
R002	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R003	RD14BB2C221J	RES. CARBON	220	5%	1/6W

REF.NO	PARTS NO	NAME & DESCRIPTION			
R004	R92-1402-05	RES. SPR2L15	24	5%	
R005	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R006	RN14BK2C2002F	RES. METAL FILM	20K	1%	1/6W
R007	RN14BK2C2002F	RES. METAL FILM	20K	1%	1/6W
R008	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R009	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R010	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R011	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R012	R92-1401-05	RES. SPR2L15	15	5%	
R013	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R014	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R015	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R016	RN14BK2C2002F	RES. METAL FILM	20K	1%	1/6W
R017	R92-1404-05	RES. SPR2L15	4.7K	5%	
R018	R92-1405-05	RES. SPR1/2L10	18K	5%	
R019	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R020	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R021	RN14BK2C2403F	RES. METAL FILM	240K	1%	1/6W
R022	RN14BK2C2002F	RES. METAL FILM	20K	1%	1/6W
R023	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R024	R92-1403-05	RES. SPR2L15	1K	5%	
R025	R92-1406-05	RES. SPR1/2L10	13K	5%	
R026	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R027	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R028	RN14BK2C1303F	RES. METAL FILM	130K	1%	1/6W
R029	RN14BK2C2002F	RES. METAL FILM	20K	1%	1/6W
R030	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R033	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R034	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R035	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R036	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R037	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R038	RD14BB2C683J	RES. CARBON	68K	5%	1/6W
R039	RD14BB2C114J	RES. CARBON	110K	5%	1/6W
R040	RD14BB2C912J	RES. CARBON	9.1K	5%	1/6W
R041	RD14BB2E470J	RES. CARBON	47	5%	1/4W
R042	RD14BB2C334J	RES. CARBON	330K	5%	1/6W
R043	RD14BB2C823J	RES. CARBON	82K	5%	1/6W
R044	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R045	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R046	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R047	RD14BB2C334J	RES. CARBON	330K	5%	1/6W
R048	RD14BB2C683J	RES. CARBON	68K	5%	1/6W
R049	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R050	RD14BB2C113J	RES. CARBON	11K	5%	1/6W
R051	RD14BB2E470J	RES. CARBON	47	5%	1/4W
R052	R92-1034-05	RES. METAL FILM	47M	5%	1/2W
R053	R92-1034-05	RES. METAL FILM	47M	5%	1/2W
R054	R92-1125-05	RES. METAL FILM	7.5M	1%	1W
R055	R92-1125-05	RES. METAL FILM	7.5M	1%	1W
R056	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R057	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R058	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R059	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R060	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R061	RD14BB2E473J	RES. CARBON	47K	5%	1/4W
R062	R92-1153-05	RES. METAL FILM	5.1M	5%	1W
R063	R92-1193-05	RES. METAL FILM	8.2M	5%	1W
R064	RD14BB2C753J	RES. CARBON	75K	5%	1/6W
R065	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R066	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R067	RD14BB2C393J	RES. CARBON	39K	5%	1/6W
R068	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R069	RD14BB2C433J	RES. CARBON	43K	5%	1/6W
R070	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R071	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R072	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R073	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R074	NO USE				
R075	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R076	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R077	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R078	RD14BB2C203J	RES. CARBON	20K	5%	1/6W
R079	RD14BB2C203J	RES. CARBON	20K	5%	1/6W
R080	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R081	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R082	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R083	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R084	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R085	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R086	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R087	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
U001	NJM4558D	IC, OP AMP			
U002	NJM4558D	IC, OP AMP			
U003	NJM4558D	IC, OP AMP			
U004	NJM4558D	IC, OP AMP			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
VR001	R12-1538-05	RES. SEMI FIXED 1KB
VR002	R12-5526-05	RES. SEMI FIXED 100KB
VR003	NO USE	
VR004	R12-8001-05	RES. SEMI FIXED 2.2MB
VR005	R12-4416-05	RES. SEMI FIXED 50KB
VR006	R12-1538-05	RES. SEMI FIXED 1KB

V.PRE UNIT

X73-1750-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E31-2809-05	WIRE ASS'Y (CH2 INV)			
	E31-2810-05	WIRE ASS'Y (CH2 POSI)			
	E31-2811-05	WIRE ASS'Y (CH1 POSI)			
	E31-2904-05	WIRE ASS'Y			
	F10-1590-14	SHIELD PLATE			
	F10-1603-04	SHIELD PLATE			
	J25-5174-12	P.C.B. (UNMOUNTED)			
	R01-2519-05	V.R. (CH1 POSI)	5KB		
	R01-2520-05	V.R. (CH2 POSI)	5KB.SW		
C001	C91-0501-05	CAP. METAL FILM	0.047	10%	630V
C002	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C003	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C004	CE04HW1E220M	CAP. ELECTRO	22	20%	25V
C005	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C006	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C007	CC45FCH1H330J	CAP. CERAMIC	33P	5%	50V
C008	CC45FCH1H100D	CAP. CERAMIC	10P	0.5P	50V
C009	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C010	CC45FSL1H471J	CAP. CERAMIC	470P	5%	50V
C011	CC45FCH1H070D	CAP. CERAMIC	7P	0.5P	50V
C012	CC45FCH1H070D	CAP. CERAMIC	7P	0.5P	50V
C013	CC45FCH1H050C	CAP. CERAMIC	5P	0.25P	50V
C014	CC45FSL1H221J	CAP. CERAMIC	220P	5%	50V
C015	CC45FSL1H471J	CAP. CERAMIC	470P	5%	50V
C016	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C017	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C018	CC45FCH1H020C	CAP. CERAMIC	2P	0.25P	50V
C019	CC45FSL1H681J	CAP. CERAMIC	680P	5%	50V
C101	C91-0501-05	CAP. METAL FILM	0.047	10%	630V
C102	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C103	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C104	CE04HW1E220M	CAP. ELECTRO	22	20%	25V
C105	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C106	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C107	CC45FCH1H330J	CAP. CERAMIC	33P	5%	50V
C108	CC45FCH1H100D	CAP. CERAMIC	10P	0.5P	50V
C109	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C110	CC45FSL1H471J	CAP. CERAMIC	470P	5%	50V
C111	CC45FCH1H070D	CAP. CERAMIC	7P	0.5P	50V
C112	CC45FCH1H070D	CAP. CERAMIC	7P	0.5P	50V
C113	CC45FCH1H050C	CAP. CERAMIC	5P	0.25P	50V
C114	CC45FSL1H221J	CAP. CERAMIC	220P	5%	50V
C115	CC45FSL1H471J	CAP. CERAMIC	470P	5%	50V
C116	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C119	CC45FSL1H681J	CAP. CERAMIC	680P	5%	50V
C120	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C121	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C122	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C202	CC45FCH1H180J	CAP. CERAMIC	18P	5%	50V
C203	CC45FCH1H180J	CAP. CERAMIC	18P	5%	50V
C204	CC45FCH1H150J	CAP. CERAMIC	15P	5%	50V
C205	NO USE				
C206	CC45FCH1H150J	CAP. CERAMIC	15P	5%	50V
C207	NO USE				
C208	CC45FSL1H151J	CAP. CERAMIC	150P	5%	50V
C211	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C214	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C215	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C216	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C217	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C218	NO USE				
C219	CE04HW1E220M	CAP. ELECTRO	22	20%	25V
C220	CQ92FM1H473K	CAP. MYLAR	0.047	10%	50V
C230	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C231	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C232	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C501	CC45FCH1H220J	CAP. CERAMIC	22P	5%	50V
C502	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C503	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C504	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C505	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C506	NO USE				
C507	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C508	CC45FCH1H100D	CAP. CERAMIC	10P	0.5P	50V
C509	CC45FCH1H040C	CAP. CERAMIC	4P	0.25P	50V
C510	CC45FCH1H030C	CAP. CERAMIC	3P	0.25P	50V
C511	CC45FCH1H030C	CAP. CERAMIC	3P	0.25P	50V
C512	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C520	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C601	CC45FCH1H220J	CAP. CERAMIC	22P	5%	50V
C602	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C603	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C604	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C605	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C606	NO USE				
C607	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C608	CC45FCH1H100D	CAP. CERAMIC	10P	0.5P	50V
C609	CC45FCH1H040C	CAP. CERAMIC	4P	0.25P	50V
C610	NO USE				
C611	CC45FCH1H030C	CAP. CERAMIC	3P	0.25P	50V
C612	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C700	CE04EW1C471M	CAP. ELECTRO	470	20%	16V
C701	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C702	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C703	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C706	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C707	NO USE				
C708	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C709	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C710	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C711	NO USE				
C712	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C750	CE04EW1C471M	CAP. ELECTRO	470	20%	16V
C751	NO USE				
C752	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C753	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C754	NO USE				
C755	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C756	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C757	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C758	NO USE				
C759	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C760	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C761	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C762	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C763	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C764	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C771	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C805	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C806	CE04EW1C221M	CAP. ELECTRO	220	20%	16V
C901	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C902	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C903	CK45F1H103Z	CAP. CERAMIC	0.01		50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	MA700	DIODE			
D005	MA700	DIODE			
D006	MTZ5.1JB	DIODE, ZENER	5.0V		
D101	1SS132	DIODE			
D102	1SS132	DIODE			
D103	1SS132	DIODE			
D104	MA700	DIODE			
D105	MA700	DIODE			
D106	MTZ5.1JB	DIODE, ZENER	5.0V		
D201	MTZ6.2JB	DIODE, ZENER	6.1V		
D202	1SS132	DIODE			
D203	1SS132	DIODE			
D204	1SS132	DIODE			
D205	1SS132	DIODE			
D206	1SS132	DIODE			
D207	MTZ6.2JB	DIODE, ZENER	6.1V		
D208	NO USE				
D209	2SA1005(K)	TR. SI, PNP			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION	
D214	2SA1005(K)	TR. SI, PNP	
D501	1SS132	DIODE	
D502	1SS132	DIODE	
D503	1SS132	DIODE	
D504	1SS132	DIODE	
D505	MTZ6.2JB	DIODE, ZENER	6.1V
D506	MA700	DIODE	
D507	MA700	DIODE	
D508	MA700	DIODE	
D509	MA700	DIODE	
D510	MA700	DIODE	
D511	MA700	DIODE	
D512	MA700	DIODE	
D513	MA700	DIODE	
D601	1SS132	DIODE	
D602	1SS132	DIODE	
D603	1SS132	DIODE	
D604	1SS132	DIODE	
D605	MTZ6.2JB	DIODE, ZENER	6.1V
D606	MA700	DIODE	
D607	MA700	DIODE	
D608	MA700	DIODE	
D609	MA700	DIODE	
D610	MA700	DIODE	
D611	MA700	DIODE	
D612	MA700	DIODE	
D613	MA700	DIODE	
P003	E40-0273-05	PIN CONNECTOR	2P
P004	E40-0573-05	PIN CONNECTOR	5P
P005	NO USE		
P006	E40-0373-05	PIN CONNECTOR	3P
P007	E40-0373-05	PIN CONNECTOR	3P
P008	E40-0473-05	PIN CONNECTOR	4P
P009	E40-0673-05	PIN CONNECTOR	6P
P010	E40-0273-05	PIN CONNECTOR	2P
P011	E40-0673-05	PIN CONNECTOR	6P
P012	E40-0273-05	PIN CONNECTOR	2P
P013	E40-0373-05	PIN CONNECTOR	3P
P014	NO USE		
P015	E40-0573-05	PIN CONNECTOR	5P
P016	E40-0773-05	PIN CONNECTOR	7P
P017	E40-0673-05	PIN CONNECTOR	6P
P056	E40-0573-05	PIN CONNECTOR	5P
P066	E40-0473-05	PIN CONNECTOR	4P
P067	E40-0473-05	PIN CONNECTOR	4P
P068	E40-0473-05	PIN CONNECTOR	4P
Q001	2SC3354(S,T)	TR. SI, NPN	
Q002	2SC3354(S,T)	TR. SI, NPN	
Q003	2SK404(F)	FET. N-CHANNEL	
Q004	2SC3354(S,T)	TR. SI, NPN	
Q005	2SC2671(H)	TR. SI, NPN	
Q006	2SC4072	TR. SI, NPN	
Q007	NO USE		
Q008	2SC3381(GR)	TR. SI, NPN	
Q009	2SC3354(S,T)	TR. SI, NPN	
Q010	2SC3354(S,T)	TR. SI, NPN	
Q011	2SC2671(H)	TR. SI, NPN	
Q012	2SC2671(H)	TR. SI, NPN	
Q013	2SC3354(S,T)	TR. SI, NPN	
Q014	2SC2671(H)	TR. SI, NPN	
Q015	2SC2671(H)	TR. SI, NPN	
Q016	2SA1206(K)	TR. SI, PNP	
Q017	2SA1206(K)	TR. SI, PNP	
Q018	2SC2671(H)	TR. SI, NPN	
Q019	2SC2671(H)	TR. SI, NPN	
Q101	2SC3354(S,T)	TR. SI, NPN	
Q102	2SC3354(S,T)	TR. SI, NPN	
Q103	2SK404(F)	FET. N-CHANNEL	
Q104	2SC3354(S,T)	TR. SI, NPN	
Q105	2SC2671(H)	TR. SI, NPN	
Q106	2SC4072	TR. SI, NPN	
Q107	NO USE		
Q108	2SC3381(GR)	TR. SI, NPN	
Q109	2SC3354(S,T)	TR. SI, NPN	
Q110	2SC3354(S,T)	TR. SI, NPN	
Q111	2SC2671(H)	TR. SI, NPN	
Q112	2SC2671(H)	TR. SI, NPN	
Q113	2SC3354(S,T)	TR. SI, NPN	
Q114	2SC2671(H)	TR. SI, NPN	
Q115	2SC2671(H)	TR. SI, NPN	
Q116	2SA1206(K)	TR. SI, PNP	

REF.NO	PARTS NO	NAME & DESCRIPTION			
Q117	2SA1206(K)	TR. SI, PNP			
Q118	2SA1206(K)	TR. SI, PNP			
Q119	2SA1206(K)	TR. SI, PNP			
Q120	2SC2671(H)	TR. SI, NPN			
Q121	2SC2671(H)	TR. SI, NPN			
Q201	2SC2785(F)	TR. SI, NPN			
Q202	2SC2785(F)	TR. SI, NPN			
Q203	2SC3354(S,T)	TR. SI, NPN			
Q204	2SC3354(S,T)	TR. SI, NPN			
Q205	2SC2785(F)	TR. SI, NPN			
Q206	2SC2785(F)	TR. SI, NPN			
Q207	2SC3354(S,T)	TR. SI, NPN			
Q208	2SC3354(S,T)	TR. SI, NPN			
Q209	NO USE				
Q210	2SC3354(S,T)	TR. SI, NPN			
Q211	2SC3354(S,T)	TR. SI, NPN			
Q212	2SA1206(K)	TR. SI, PNP			
Q213	2SA1206(K)	TR. SI, PNP			
Q214	NO USE				
Q215	2SC3354(S,T)	TR. SI, NPN			
Q216	2SC3354(S,T)	TR. SI, NPN			
Q217	2SC3354(S,T)	TR. SI, NPN			
Q218	2SC3354(S,T)	TR. SI, NPN			
Q252	2SK404(F)	FET. N-CHANNEL			
Q253	NO USE				
Q254	2SC3354(S,T)	TR. SI, NPN			
Q255	2SC2785(F)	TR. SI, NPN			
Q256	2SC2785(F)	TR. SI, NPN			
Q257	2SC2785(F)	TR. SI, NPN			
Q258	2SC2785(F)	TR. SI, NPN			
Q259	2SC3354(S,T)	TR. SI, NPN			
Q260	2SC3354(S,T)	TR. SI, NPN			
Q261	2SC3354(S,T)	TR. SI, NPN			
Q262	2SC3354(S,T)	TR. SI, NPN			
Q503	2SC3354(S,T)	TR. SI, NPN			
Q504	2SC3354(S,T)	TR. SI, NPN			
Q505	2SC2671(H)	TR. SI, NPN			
Q506	2SA1206(K)	TR. SI, PNP			
Q507	2SA1206(K)	TR. SI, PNP			
Q508	2SA1206(K)	TR. SI, PNP			
Q509	2SK117(Y)	FET. N-CHANNEL			
Q510	2SK117(Y)	FET. N-CHANNEL			
Q511	2SC2785(F)	TR. SI, NPN			
Q512	2SC2785(F)	TR. SI, NPN			
Q513	2SC2785(F)	TR. SI, NPN			
Q514	2SC2785(F)	TR. SI, NPN			
Q603	2SC3354(S,T)	TR. SI, NPN			
Q604	2SC3354(S,T)	TR. SI, NPN			
Q605	2SC2671(H)	TR. SI, NPN			
Q606	2SA1206(K)	TR. SI, PNP			
Q607	2SA1206(K)	TR. SI, PNP			
Q608	2SA1206(K)	TR. SI, PNP			
Q609	2SK117(Y)	FET. N-CHANNEL			
Q610	2SK117(Y)	FET. N-CHANNEL			
Q611	2SC2785(F)	TR. SI, NPN			
Q612	2SC2785(F)	TR. SI, NPN			
Q613	2SC2785(F)	TR. SI, NPN			
Q614	2SC2785(F)	TR. SI, NPN			
R001	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R002	NO USE				
R003	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R004	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R005	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R006	RN14BK2C1803F	RES. METAL FILM	180K	1%	1/6W
R007	RN14BK2C8203F	RES. METAL FILM	820K	1%	1/6W
R008	RD14BB2C684J	RES. CARBON	680K	5%	1/6W
R009	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R010	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R011	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R012	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R013	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R014	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R015	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R016	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R017	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R018	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R019	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R020	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R021	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R022	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R023	RD14BB2C150J	RES. CARBON	15	5%	1/6W
R024	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R025	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R026	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R027	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R028	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R029	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R030	RD14BB2C680J	RES. CARBON	68	5%	1/6W
R031	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R032	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R033	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R034	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R035	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R036	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R037	RD14BB2C560J	RES. CARBON	56	5%	1/6W
R038	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R039	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R040	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R041	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R042	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R043	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R044	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R045	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R046	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R047	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R048	RD14BB2C241J	RES. CARBON	240	5%	1/6W
R049	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R050	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R051	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R052	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R053	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R054	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R055	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R056	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R057	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R058	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R059	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R060	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R061	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R062	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R063	RN14BK2C1800F	RES. METAL FILM	180	1%	1/6W
R064	RD14BB2C303J	RES. CARBON	30K	5%	1/6W
R065	RN14BK2C5100F.	RES. METAL FILM	510	1%	1/6W
R066	RN14BK2C5100F	RES. METAL FILM	510	1%	1/6W
R067	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R068	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R069	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R070	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R071	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R072	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R073	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R074	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R075	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R076	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R077	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R078	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R079	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R080	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R081	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R082	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R087	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R101	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R102	NO USE				
R103	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R104	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R105	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R106	RN14BK2C1803F	RES. METAL FILM	180K	1%	1/6W
R107	RN14BK2C8203F	RES. METAL FILM	820K	1%	1/6W
R108	RD14BB2C684J	RES. CARBON	680K	5%	1/6W
R109	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R110	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R111	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R112	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R113	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R114	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R115	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R116	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R117	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R118	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R119	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R120	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R121	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R122	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R123	RD14BB2C150J	RES. CARBON	15	5%	1/6W
R124	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R125	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R126	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R127	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W

REF.NO	PARTS NO	NAME & DESCRIPTION			
R128	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R129	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R130	RD14BB2C680J	RES. CARBON	68	5%	1/6W
R131	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R132	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R133	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R134	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R135	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R136	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R137	RD14BB2C560J	RES. CARBON	56	5%	1/6W
R138	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R139	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R140	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R141	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R142	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R143	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R144	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R145	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R146	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R147	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R148	RD14BB2C241J	RES. CARBON	240	5%	1/6W
R149	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R150	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R151	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R152	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R153	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R154	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R155	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R156	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R157	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R158	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R159	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R160	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R161	RD14BB2C112J	RES. CARBON	1.1K	5%	1/6W
R162	RD14BB2C112J	RES. CARBON	1.1K	5%	1/6W
R163	RN14BK2C1800F	RES. METAL FILM	180	1%	1/6W
R164	RD14BB2C303J	RES. CARBON	30K	5%	1/6W
R165	RN14BK2C5100F	RES. METAL FILM	510	1%	1/6W
R166	RN14BK2C5100F	RES. METAL FILM	510	1%	1/6W
R167	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R168	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R169	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R170	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R171	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R172	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R173	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R174	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R175	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R176	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R177	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R178	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R179	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R180	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R181	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R182	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R183	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R184	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R185	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R186	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R187	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R188	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R201	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R202	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R203	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R204	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R205	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R206	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R207	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R208	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R209	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R210	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R211	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R212	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R213	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R214	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R215	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R216	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R217	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R218	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R219	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R220	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R221	NO USE				
R222	RN14BK2C1800F	RES. METAL FILM	180	1%	1/6W
R223	RN14BK2C1800F	RES. METAL FILM	180	1%	1/6W
R224	RN14BK2C1500F	RES. METAL FILM	150	1%	1/6W
R225	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R226	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R227	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R228	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R229	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R230	RD14BB2C183J	RES. CARBON	18K	5%	1/6W
R231	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R232	RD14BB2C183J	RES. CARBON	18K	5%	1/6W
R233	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R234	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R235	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R236	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R237	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R238	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R240	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R241	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R242	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R243	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R244	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R247	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R248	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R249	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R250	NO USE				
R251	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R252	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R253	RD14BB2C684J	RES. CARBON	680K	5%	1/6W
R254	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R255	NO USE				
R256	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R257	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R258	NO USE				
R259	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R260	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R261	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R262	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R263	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R264	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R265	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R266	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R267	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R268	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R269	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R270	NO USE				
R271	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R272	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R273	RD14BB2C161J	RES. CARBON	160	5%	1/6W
R280	R90-0643-05	RES. NETWORK	100KX7		
R281	R90-0642-05	RES. NETWORK	100KX6		
R282	R90-0644-05	RES. NETWORK	4.7KX5		
R283	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R284	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R294	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R295	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R296	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R299	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R505	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R506	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R507	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R508	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R509	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R510	RD14BB2C393J	RES. CARBON	39K	5%	1/6W
R511	RD14BB2C911J	RES. CARBON	910	5%	1/6W
R512	RN14BK2C3602F	RES. METAL FILM	36K	1%	1/6W
R513	RN14BK2C3602F	RES. METAL FILM	36K	1%	1/6W
R514	RN14BK2C1802F	RES. METAL FILM	18K	1%	1/6W
R515	RN14BK2C3302F	RES. METAL FILM	33K	1%	1/6W
R516	RN14BK2C3302F	RES. METAL FILM	33K	1%	1/6W
R517	RN14BK2C3600F	RES. METAL FILM	360	1%	1/6W
R518	RD14BB2C4R7J	RES. CARBON	4.7	5%	1/6W
R519	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R520	RD14BB2C273J	RES. CARBON	27K	5%	1/6W
R521	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R522	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R523	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R524	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R525	RD14BB2C620J	RES. CARBON	62	5%	1/6W
R526	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R527	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R528	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R529	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R530	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R531	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R532	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R533	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R534	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R535	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R536	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R537	NO USE				
R538	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R539	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R542	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R543	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R544	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R547	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R548	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R549	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R550	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R551	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R552	RN14BK2C2701F	RES. METAL FILM	2.7K	1%	1/6W
R553	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R554	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R555	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R556	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R557	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R558	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R559	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R560	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R561	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R562	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R563	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R570	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R605	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R606	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R607	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R608	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R609	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R610	RD14BB2C393J	RES. CARBON	39K	5%	1/6W
R611	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R612	RN14BK2C3602F	RES. METAL FILM	36K	1%	1/6W
R613	RN14BK2C3602F	RES. METAL FILM	36K	1%	1/6W
R614	RN14BK2C1802F	RES. METAL FILM	18K	1%	1/6W
R615	RN14BK2C3302F	RES. METAL FILM	33K	1%	1/6W
R616	RN14BK2C3302F	RES. METAL FILM	33K	1%	1/6W
R617	RN14BK2C3600F	RES. METAL FILM	360	1%	1/6W
R618	RD14BB2C4R7J	RES. CARBON	4.7	5%	1/6W
R619	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R620	RD14BB2C273J	RES. CARBON	27K	5%	1/6W
R621	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R622	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R623	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R624	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R625	RD14BB2C620J	RES. CARBON	62	5%	1/6W
R626	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R627	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R628	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R629	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R630	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R631	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R632	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R633	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R634	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R635	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R636	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R637	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R638	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R639	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R642	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R643	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R644	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R647	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R648	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R649	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R650	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R651	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R652	RN14BK2C2701F	RES. METAL FILM	2.7K	1%	1/6W
R653	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R654	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R655	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R656	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R657	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R658	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R659	RD14BB2C302J	RES. CARBON	3K	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R660	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R661	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R662	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R663	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R670	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R701	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R702	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R703	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R704	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R705	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R706	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R707	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R708	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R709	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R710	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R711	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R712	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R713	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R720	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R721	RD14BB2C101J	RES. CARBON	100	5%	1/6W
S001	S02-4507-05	ROTARY SWITCH, V.R. (V.ATT)			
S002	S32-4007-05	LEVER SWITCH 4-3			
S101	S02-4507-05	ROTARY SWITCH, V.R. (V.ATT)			
S102	S32-4007-05	LEVER SWITCH 4-3			
S201	S33-2501-05	LEVER SWITCH 2-5			
TC001	C05-0444-05	CAP. TRIMMER	10P		
TC002	C05-0446-05	CAP. TRIMMER	30P		
TC101	C05-0444-05	CAP. TRIMMER	10P		
TC102	C05-0446-05	CAP. TRIMMER	30P		
TC201	C05-0447-05	CAP. TRIMMER	50P		
TC501	C05-0445-05	CAP. TRIMMER	20P		
TC502	C05-0443-05	CAP. TRIMMER	6P		
TC601	C05-0445-05	CAP. TRIMMER	20P		
TC602	C05-0443-05	CAP. TRIMMER	6P		
TH001	SDT20	THERMISTOR			
TH002	SDT20	THERMISTOR			
TH101	SDT20	THERMISTOR			
TH102	SDT20	THERMISTOR			
TH501	SDT1000	THERMISTOR			
TH601	SDT1000	THERMISTOR			
U001	LF411CN	IC,DUAL JFET INPUT OP AMP			
U101	LF411CN	IC,DUAL JFET INPUT OP AMP			
U501	NJM4558D	IC,OP AMP			
U601	NJM4558D	IC,OP AMP			
VR001	R12-4416-05	RES. SEMI FIXED 50KB			
VR002	R12-0571-05	RES. SEMI FIXED 500B			
VR003	R12-4416-05	RES. SEMI FIXED 50KB			
VR004	R12-0569-05	RES. SEMI FIXED 100B			
VR005	R12-0570-05	RES. SEMI FIXED 200B			
VR006	S02-4507-05	ROTARY SWITCH, V.R. (V.ATT)			
VR007	S02-4507-05	ROTARY SWITCH, V.R. (V.ATT)			
VR008	R12-0569-05	RES. SEMI FIXED 100B			
VR101	R12-4416-05	RES. SEMI FIXED 50KB			
VR102	R12-0571-05	RES. SEMI FIXED 500B			
VR103	R12-4416-05	RES. SEMI FIXED 50KB			
VR104	R12-0569-05	RES. SEMI FIXED 100B			
VR105	R12-0570-05	RES. SEMI FIXED 200B			
VR106	S02-4507-05	ROTARY SWITCH, V.R. (V.ATT)			
VR107	S02-4507-05	ROTARY SWITCH, V.R. (V.ATT)			
VR108	R12-0570-05	RES. SEMI FIXED 200B			
VR109	R12-0569-05	RES. SEMI FIXED 100B			
VR201	R12-0570-05	RES. SEMI FIXED 200B			
VR202	R12-0570-05	RES. SEMI FIXED 200B			
VR501	R12-4416-05	RES. SEMI FIXED 50KB			
VR502	R12-1538-05	RES. SEMI FIXED 1KB			
VR503	R12-3453-05	RES. SEMI FIXED 10KB			
VR504	R12-0569-05	RES. SEMI FIXED 100B			

REF.NO	PARTS NO	NAME & DESCRIPTION
VR601	R12-4416-05	RES. SEMI FIXED 50KB
VR602	R12-1538-05	RES. SEMI FIXED 1KB
VR603	R12-3453-05	RES. SEMI FIXED 10KB
VR604	R12-0569-05	RES. SEMI FIXED 100B
VR605	R12-2520-05	RES. SEMI FIXED 5KB

SWEEP UNIT

X74-1470-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E31-2828-05	WIRE ASS'Y (H.POSI)			
	E31-2829-05	WIRE ASS'Y (TRIG LEVEL)			
	E40-0216-05	PIN CONNECTOR 2P (FOR D207)			
	J25-5177-12	P.C.B. (UNMOUNTED)			
C001	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C002	CQ92FM1H104J	CAP. MYLAR	0.1	5%	50V
C003	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C004	CQ92FM1H473J	CAP. MYLAR	0.047	5%	50V
C005	CK45FB1H222K	CAP. CERAMIC	2200P	10%	50V
C006	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C007	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C008	NO USE				
C009	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C010	CE04HW1E220M	CAP. ELECTRO	22	20%	25V
C011	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C012	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C013	CQ92FM1H104J	CAP. MYLAR	0.1	5%	50V
C014	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C015	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C016	CK45FB1H222K	CAP. CERAMIC	2200P	10%	50V
C017	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C018	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C054	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C101	CC45FCH1H100D	CAP. CERAMIC	10P	0.5P	50V
C102	CC45FCH1H330J	CAP. CERAMIC	33P	5%	50V
C103	CE04EW1E100M	CAP. ELECTRO	10	20%	25V
C104	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C105	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C106	NO USE				
C107	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C108	CC45FSL1H221J	CAP. CERAMIC	220P	5%	50V
C109	CC45FCH1H270J	CAP. CERAMIC	27P	5%	50V
C110	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C111	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C112	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C113	C91-1246-05	CAP. FILM	4.7	5%	
C114	CQ93AP2A392J	CAP. MYLAR	3900P	5%	100V
C115	C91-1247-05	CAP. FILM	0.047	2%	
C116	CM93BD2A391J	CAP. MICA	390P	5%	100V
C117	NO USE				
C118	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C119	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C120	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C121	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C122	C91-1245-05	CAP. CERAMIC	0.1		12V
C123	CQ92FM1H103J	CAP. MYLAR	0.01	5%	50V
C124	CC45FSL1H221J	CAP. CERAMIC	220P	5%	50V
C125	CC45FSL1H331J	CAP. CERAMIC	330P	5%	50V
C201	CC45FCH1H220J	CAP. CERAMIC	22P	5%	50V
C202	CC45FCH1H910J	CAP. CERAMIC	91P	5%	50V
C203	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C204	NO USE				
C205	CC45FSL1H221J	CAP. CERAMIC	220P	5%	50V
C206	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C207	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C208	CC45FCH1H070D	CAP. CERAMIC	7P	0.5P	50V
C209	CC45FCH1H070D	CAP. CERAMIC	7P	0.5P	50V
C210	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C211	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C212	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C401	CQ92FM1H104J	CAP. MYLAR	0.1	5%	50V
C402	CQ92FM1H104J	CAP. MYLAR	0.1	5%	50V
C403	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C404	CC45FCH1H100D	CAP. CERAMIC	10P	0.5P	50V
C405	NO USE				
C406	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C407	CC45FCH1H100D	CAP. CERAMIC	10P	0.5P	50V
C408	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C501	CE04EW1C102M	CAP. ELECTRO	1000	20%	16V

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
C502	NO USE				
C503	CE04EW1C102M	CAP. ELECTRO	1000	20%	16V
C504	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C505	CE04EW1C221M	CAP. ELECTRO	220	20%	16V
C506	NO USE				
C507	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C508	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C509	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C510	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C511	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C512	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C513	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C514	NO USE				
C515	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C516	C91-1245-05	CAP. CERAMIC	0.1		12V
C517	NO USE				
C518	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C519	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C520	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C521	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C522	NO USE				
C523	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C524	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C525	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C526	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C527	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C528	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C529	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C530	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C531	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C532	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C533	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C534	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C535	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C536	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C537	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C538	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C539	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C540	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C541	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C542	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C543	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C544	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C545	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C901	CK45F1H103Z	CAP. CERAMIC	0.01		50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SS132	DIODE			
D005	1SS132	DIODE			
D006	1SS132	DIODE			
D007	1SS132	DIODE			
D008	1SS132	DIODE			
D101	1SS132	DIODE			
D102	1SS132	DIODE			
D103	1SS132	DIODE			
D106	1SS132	DIODE			
D107	1SS132	DIODE			
D108	NO USE				
D109	1SS132	DIODE			
D110	1SS132	DIODE			
D111	1SS132	DIODE			
D112	MA700	DIODE			
D113	MA700	DIODE			
D114	MA700	DIODE			
D115	MA700	DIODE			
D201	1SS132	DIODE			
D202	1SS132	DIODE			
D203	1SS132	DIODE			
D204	1SS132	DIODE			
D205	1SS132	DIODE			
D206	MA700	DIODE			
D207	B30-0957-05	LED (LN322GPT.POWER)			
D208	MA700	DIODE			
D401	1SS132	DIODE			
D402	1SS132	DIODE			
D403	MA700	DIODE			
D404	1SS132	DIODE			
D405	1SS132	DIODE			
D406	1SS132	DIODE			
D407	1SS132	DIODE			
D408	1SS132	DIODE			
D409	1SS132	DIODE			

REF.NO	PARTS NO	NAME & DESCRIPTION	
D901	MA700	DIODE	
P010	E40-0273-05	PIN CONNECTOR	2P
P011	E40-0673-05	PIN CONNECTOR	6P
P012	E40-0573-05	PIN CONNECTOR	5P
P024	E40-0473-05	PIN CONNECTOR	4P
P025	E40-0473-05	PIN CONNECTOR	4P
P026	E40-0273-05	PIN CONNECTOR	2P
P027	E40-0473-05	PIN CONNECTOR	4P
P028	E40-0673-05	PIN CONNECTOR	6P
P029	E40-0573-05	PIN CONNECTOR	5P
P030	E40-0473-05	PIN CONNECTOR	4P
P033	E40-0473-05	PIN CONNECTOR	4P
P034	NO USE		
P035	E40-0673-05	PIN CONNECTOR	6P
P036	E40-0473-05	PIN CONNECTOR	4P
P037	E40-0773-05	PIN CONNECTOR	7P
P038	E40-0873-05	PIN CONNECTOR	8P
P068	E40-0473-05	PIN CONNECTOR	4P
Q001	2SA1206(K)	TR. SI, PNP	
Q002	2SA1005(K)	TR. SI, PNP	
Q003	2SK241(Y)	FET. N-CHANNEL	
Q004	2SK241(Y)	FET. N-CHANNEL	
Q005	2SC2671(H)	TR. SI, NPN	
Q006	2SC2671(H)	TR. SI, NPN	
Q007	2SA1005(K)	TR. SI, PNP	
Q008	2SA1005(K)	TR. SI, PNP	
Q009	2SC2785(F)	TR. SI, NPN	
Q010	2SC2785(F)	TR. SI, NPN	
Q011	2SC2785(F)	TR. SI, NPN	
Q012	NO USE		
Q013	2SC2785(F)	TR. SI, NPN	
Q014	2SC2785(F)	TR. SI, NPN	
Q015	2SC2785(F)	TR. SI, NPN	
Q101	2SC2785(F)	TR. SI, NPN	
Q102	2SC2785(F)	TR. SI, NPN	
Q103	NO USE		
Q104	2SA1005(K)	TR. SI, PNP	
Q105	2SC3354(S,T)	TR. SI, NPN	
Q106	2SC2785(F)	TR. SI, NPN	
Q107	2SC2786(K)	TR. SI, NPN	
Q108	2SC2786(K)	TR. SI, NPN	
Q109	2SC2786(K)	TR. SI, NPN	
Q110	2SC2785(F)	TR. SI, NPN	
Q111	2SC2785(F)	TR. SI, NPN	
Q112	2SC2785(F)	TR. SI, NPN	
Q113	NO USE		
Q114	2SA1005(K)	TR. SI, PNP	
Q115	2SC2786(K)	TR. SI, NPN	
Q116	2SC2786(K)	TR. SI, NPN	
Q117	NO USE		
Q118	2SA1175(F)	TR. SI, PNP	
Q119	2SA1175(F)	TR. SI, PNP	
Q203	2SC3354(S.T)	TR. SI, NPN	
Q204	2SA1175(F)	TR. SI, PNP	
Q205	2SA1175(F)	TR. SI, PNP	
Q206	2SA1175(F)	TR. SI, PNP	
Q207	2SA1175(F)	TR. SI, PNP	
Q208	2SC2785(F)	TR. SI, NPN	
Q209	2SC2785(F)	TR. SI, NPN	
Q210	2SA1175(F)	TR. SI, PNP	
Q211	2SC2785(F)	TR. SI, NPN	
Q212	2SC2786(K)	TR. SI, NPN	
Q213	2SC2785(F)	TR. SI, NPN	
Q214	2SC2786(K)	TR. SI, NPN	
Q215	2SC2786(K)	TR. SI, NPN	
Q216	2SC2785(F)	TR. SI, NPN	
Q401	2SC2785(F)	TR. SI, NPN	
Q402	2SC2785(F)	TR. SI, NPN	
Q403	2SC2785(F)	TR. SI, NPN	
Q404	2SC2671(H)	TR. SI, NPN	
Q405	2SC2671(H)	TR. SI, NPN	
Q406	2SC3354(S.T)	TR. SI, NPN	
Q407	2SA1206(K)	TR. SI, PNP	
Q408	2SA1175(F)	TR. SI, PNP	
Q409	2SC2785(F)	TR. SI, NPN	
Q410	2SA1175(F)	TR. SI, PNP	
Q411	2SA1175(F)	TR. SI, PNP	
Q412	2SA1175(F)	TR. SI, PNP	
Q413	2SC2785(F)	TR. SI, NPN	

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R001	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R002	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R003	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R004	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R005	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R006	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R007	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R008	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R009	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R010	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R011	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R012	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R013	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R014	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R015	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R016	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R017	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R018	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R019	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R020	RD14BB2C820J	RES. CARBON	82	5%	1/6W
R021	RD14BB2C820J	RES. CARBON	82	5%	1/6W
R022	RN14BK2C82R0F	RES. METAL FILM	82.0	1%	1/6W
R023	NO USE				
R024	RN14BK2C2400F	RES. METAL FILM	240	1%	1/6W
R025	RN14BK2C2400F	RES. METAL FILM	240	1%	1/6W
R026	RN14BK2C2701F	RES. METAL FILM	2.7K	1%	1/6W
R027	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R028	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R029	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R030	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R031	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R032	RN14BK2C1602F	RES. METAL FILM	16K	1%	1/6W
R033	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R034	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R035	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R036	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R037	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R038	RD14BB2C273J	RES. CARBON	27K	5%	1/6W
R039	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R040	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R041	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R042	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R043	RD14BB2C224J	RES. CARBON	220K	5%	1/6W
R044	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R045	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R046	NO USE				
R047	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R048	RD14BB2C754J	RES. CARBON	750K	5%	1/6W
R049	RD14BB2C244J	RES. CARBON	240K	5%	1/6W
R050	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R051	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R052	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R053	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R054	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R055	RD14BB2C161J	RES. CARBON	160	5%	1/6W
R056	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R057	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R058	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R059	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R101	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R102	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R103	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R104	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R105	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R106	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R107	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R108	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R109	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R110	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R111	R90-0629-05	RES. NETWORK	1KX8	5%	
R112	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R113	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R114	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R115	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R116	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R117	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R122	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R123	RN14BK2C2402F	RES. METAL FILM	24K	1%	1/6W
R124	RN14BK2C1503F	RES. METAL FILM	150K	1%	1/6W
R125	RN14BK2C2703F	RES. METAL FILM	270K	1%	1/6W
R126	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R127	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R128	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R129	RD14BB2C103J	RES. CARBON	10K	5%	1/6W

REF.NO	PARTS NO	NAME & DESCRIPTION			
R130	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R131	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R132	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R133	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R134	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R135	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R136	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R137	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R138	NO USE				
R139	RD14BB2C911J	RES. CARBON	910	5%	1/6W
R140	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R141	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R142	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R143	RN14BK2C6201F	RES. METAL FILM	6.2K	1%	1/6W
R144	RN14BK2C2402F	RES. METAL FILM	24K	1%	1/6W
R145	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R146	RN14BK2C2701F	RES. METAL FILM	2.7K	1%	1/6W
R147	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R148	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R149	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R150	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R151	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R152	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R153	RD14BB2C820J	RES. CARBON	82	5%	1/6W
R154	R90-0647-05	RES. NETWORK(SWEEP 1)			
R155	R90-0651-05	RES. NETWORK(SWEEP 2)			
R156	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R157	RN14BK2C2002F	RES. METAL FILM	20K	1%	1/6W
R158	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R159	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R160	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R161	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R201	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R202	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R203	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R204	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R205	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R206	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R207	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R208	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R209	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R210	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R211	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R212	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R213	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R214	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R215	RN14BK2C3901F	RES. METAL FILM	3.9K	1%	1/6W
R216	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R217	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R218	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R219	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R220	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R221	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R222	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R223	NO USE				
R224	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R225	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R226	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R227	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R228	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R229	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R230	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R231	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R232	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R235	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R236	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R237	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R238	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R239	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R240	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R241	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R242	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R243	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R244	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R245	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R246	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R247	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R248	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R249	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R250	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R251	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R252	RD14BB2C683J	RES. CARBON	68K	5%	1/6W
R253	RD14BB2C303J	RES. CARBON	30K	5%	1/6W
R254	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R255	RD14BB2C474J	RES. CARBON	470K	5%	1/6W
R256	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R257	R90-0645-05	RES. NETWORK	10KX4	5%	
R258	R90-0645-05	RES. NETWORK	10KX4	5%	
R259	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R260	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R261	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R401	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R402	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R403	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R404	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R405	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R406	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R407	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R408	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R409	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R410	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R411	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R412	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R413	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R414	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R415	RN14BK2C1301F	RES. METAL FILM	1.3K	1%	1/6W
R416	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R417	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R418	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R419	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R420	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R421	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R422	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R423	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R424	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R425	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R426	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R427	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R428	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R429	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R430	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R431	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R432	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R433	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R434	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R435	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R436	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R437	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R438	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R439	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R440	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R441	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R442	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R443	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R444	NO USE				
R445	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R446	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R447	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R448	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R901	RD14BB2C683J	RES. CARBON	68K	5%	1/6W
S001	S33-2501-05	LEVER SWITCH 2-5			
S002	S32-4009-05	LEVER SWITCH 4-4			
S003	S37-2005-05	LEVER SWITCH 2-4 (TRIG SOUCE)			
S004	S32-2012-05	LEVER SWITCH 2-3			
TC101	C05-0449-05	CAP. TRIMMER	100P		
TC102	C05-0445-05	CAP. TRIMMER	20P		
U101	MC10107L	IC,TRIPLE 2 INPUT EXC OR/NOR			
U102	MC10H131L	IC,DUAL D-FFS			
U103	MC10102L	IC,QUAD 2 INPUT NOR GATE			
U104	TC74HC123P	IC,DUAL MONOSTABLE MULTI			
U105	MC14051BCP	IC,ANALOG MULTIPLEXER			
U106	MC14051BCP	IC,ANALOG MULTIPLEXER			
U107	MC14051BCP	IC,ANALOG MULTIPLEXER			
U108	MC14051BCP	IC,ANALOG MULTIPLEXER			
U109	TL071CP	IC,JFET-INPUT OP AMP			
U201	SN74ALS00AN	IC,QUAD 2 INPUT NAND GATE			
U202	HD74HC00P	IC,QUAD 2 INPUT NAND GATE			
U203	HD74HC00P	IC,QUAD 2 INPUT NAND GATE			
U204	HD74HC112P	IC,DUAL FLIP-FLOPS			
U205	NJM4558D	IC,OP AMP			
U206	2SK332(F)	FET. N-CHANNEL			
U401	TC74HC123P	IC,DUAL MONOSTABLE MULTI			
U402	NO USE				
U403	HD74HC08P	IC,QUAD 2 INPUT AND GATE			
U404	HD74HC02P	IC,QUAD 2 INPUT NOR GATE			
U405	HD74HC32P	IC,QUAD 2 INPUT OR GATE			
U406	HD74HC32P	IC,QUAD 2 INPUT OR GATE			
U407	NJM4558D	IC,OP AMP			

REF.NO	PARTS NO	NAME & DESCRIPTION
VR001	R12-4416-05	RES. SEMI FIXED 50KB
VR002	R01-3514-05	V.R. 20KB (TRIG)
VR101	R12-2520-05	RES. SEMI FIXED 5KB
VR102	R01-3516-05	V.R. 100KB,SW (HOLD OFF)
VR201	R12-1538-05	RES. SEMI FIXED 1KB
VR202	R12-0570-05	RES. SEMI FIXED 200B
VR203	R01-3514-05	V.R. 20KB (H.POSI)
VR401	R12-4416-05	RES. SEMI FIXED 50KB
VR402	R12-1538-05	RES. SEMI FIXED 1KB
VR403	R12-1538-05	RES. SEMI FIXED 1KB
VR404	R12-1538-05	RES. SEMI FIXED 1KB

R/O UNIT

X77-1450-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5199-32	P.C.B. (UNMOUNTED)			
B001	W09-0407-05	LITHIUM BATTERY			
C001	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C002	C91-1245-05	CAP. CERAMIC	0.1		12V
C003	CC45FCH1H220J	CAP. CERAMIC	22P	5%	50V
C004	CC45FCH1H220J	CAP. CERAMIC	22P	5%	50V
C005	CE04JW1C220M	CAP. ELECTRO	22	20%	16V
C006	CC45FSL1H331J	CAP. CERAMIC	330P	5%	50V
C007	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C008	CF92FV1H334J	CAP. POLYESTER	0.33	5%	50V
C009	CF92FV1H334J	CAP. POLYESTER	0.33	5%	50V
C010	CF92FV1H334J	CAP. POLYESTER	0.33	5%	50V
C011	CF92FV1H334J	CAP. POLYESTER	0.33	5%	50V
C012	NO USE				
C013	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C016	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C017	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C018	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C019	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C020	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C021	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C022	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C023	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C024	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C025	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C026	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C027	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C028	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C029	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C030	CE04EW1E220M	CAP. ELECTRO	22	20%	25V
C031	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C032	C91-1245-05	CAP. CERAMIC	0.1		12V
C033	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C034	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C035	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C036	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C037	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C038	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C039	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C040	C91-1245-05	CAP. CERAMIC	0.1		12V
C041	NO USE				
C042	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C043	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C046	C91-1245-05	CAP. CERAMIC	0.1		12V
C047	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C048	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C049	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C050	C91-1245-05	CAP. CERAMIC	0.1		12V
C051	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C052	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C053	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C054	CE04EW1A222M	CAP. ELECTRO	2200	20%	10V
C055	C91-1245-05	CAP. CERAMIC	0.1		12V
C056	C91-1245-05	CAP. CERAMIC	0.1		12V
C057	C91-1245-05	CAP. CERAMIC	0.1		12V
C058	C91-1245-05	CAP. CERAMIC	0.1		12V
C059	C91-1245-05	CAP. CERAMIC	0.1		12V
C060	C91-1245-05	CAP. CERAMIC	0.1		12V
C061	C91-1245-05	CAP. CERAMIC	0.1		12V
C062	C91-1245-05	CAP. CERAMIC	0.1		12V
C063	NO USE				
C064	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C065	NO USE				

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
C066	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C067	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C068	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C069	NO USE	
C070	C91-1250-05	CAP. NETWORK 6PX5
C071	C91-1249-05	CAP. NETWORK 14PX13
C072	C91-1249-05	CAP. NETWORK 14PX13
C101	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C102	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C103	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
D001	MA700	DIODE
D002	1SS132	DIODE
D003	MA700	DIODE
D006	MA700	DIODE
L001	L40-1011-04	FERRI INDUCTOR 100UH (7H)
P015	E40-0573-05	PIN CONNECTOR 5P
P016	E40-1373-05	PIN CONNECTOR 13P
P033	E40-1273-05	PIN CONNECTOR 12P
P034	NO USE	
P035	E40-1273-05	PIN CONNECTOR 12P
P036	NO USE	
P037	E40-0773-05	PIN CONNECTOR 7P
P038	E40-0873-05	PIN CONNECTOR 8P
P057	E40-0573-05	PIN CONNECTOR 5P
P064	E40-0873-05	PIN CONNECTOR 8P
P065	E40-0473-05	PIN CONNECTOR 4P
Q001	2SC2785(F)	TR. SI. NPN
Q002	2SA1175(F)	TR. SI. PNP
Q003	2SC2785(F)	TR. SI. NPN
R001	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R002	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R003	RD14BB2C153J	RES. CARBON 15K 5% 1/6W
R004	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R005	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R006	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R007	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R008	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R009	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R010	RN14BK2C6200F	RES. METAL FILM 620 1% 1/6W
R011	RN14BK2C6200F	RES. METAL FILM 620 1% 1/6W
R012	RN14BK2C9101F	RES. METAL FILM 9.1K 1% 1/6W
R013	RN14BK2C1801F	RES. METAL FILM 1.8K 1% 1/6W
R014	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R015	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R016	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R017	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R018	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R019	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R020	RN14BK2C3602F	RES. METAL FILM 36K 1% 1/6W
R021	RD14BB2C622J	RES. CARBON 6.2K 5% 1/6W
R022	RN14BK2C7501F	RES. METAL FILM 7.5K 1% 1/6W
R023	RN14BK2C7501F	RES. METAL FILM 7.5K 1% 1/6W
R024	RN14BK2C3602F	RES. METAL FILM 36K 1% 1/6W
R025	RD14BB2C622J	RES. CARBON 6.2K 5% 1/6W
R026	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R027	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R028	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R029	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R030	RN14BK2C1101F	RES. METAL FILM 1.1K 1% 1/6W
R031	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R032	RD14BB2C512J	RES. CARBON 5.1K 5% 1/6W
R033	R90-0654-05	RES. NETWORK COMPLEX, Y
R034	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R035	RD14BB2C5R6J	RES. CARBON 5.6 5% 1/6W
R039	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R040	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R041	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R042	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R043	R90-0653-05	RES. NETWORK 10KX8 5%
R044	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R045	NO USE	
R046	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R047	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R050	RD14BB2C301J	RES. CARBON 300 5% 1/6W
R051	RD14BB2C301J	RES. CARBON 300 5% 1/6W
R052	RD14BB2C301J	RES. CARBON 300 5% 1/6W
R101	R90-0652-05	RES. NETWORK 10KX6 5%
R102	R90-0652-05	RES. NETWORK 10KX6 5%
R103	R90-0655-05	CR NETWORK
S001	S40-1522-05	SLIDE SWITCH (TIMER)
S002	S40-1521-05	TACT SWITCH (TIMER)
S003	S40-1521-05	TACT SWITCH (TIMER)
S101	S29-1503-05	ROTARY SWITCH (WITH V.R.)
U001	DAC0808LCN	IC,8 BIT D/A CONVERTER
U002	HD74HC564P	IC,OCTAL D FLIP-FLOP
U003	HD74HC244P	IC,OCTAL BUFFER
U004	HD14052BP	IC,DUAL ANALOG MULTIPLEXER
U005	HD14052BP	IC,DUAL ANALOG MULTIPLEXER
U006	HD14051BP	IC,ANALOG MULTIPLEXER
U007	MBM2764*S	IC,CHARACTER GENERATOR
U008	CTM5020	IC,GATE ARRAY (R/O CONTROLLER)
U009	AM6012DC	IC,12 BIT D/A CONVERTER
U010	LM311N	IC,VOLTAGE COMPARATOR
U011	NJM4558D	IC,OP AMP
U012	NO USE	
U013	TL072CP	IC,JFET-INPUT OP AMP
U014	HD14051BP	IC,ANALOG MULTIPLEXER
U015	HD74HC10P	IC,TRIPLE 3 INPUT NAND GATE
U016	SN74LS04N	IC,HEX INVERTER
U017	HD74HC138P	IC,3 TO 8 DECODER MULTIPLEXER
U018	HD74HC373P	IC,OCTAL D-LATCHES
U019	SN74LS244N	IC,OCTAL BUFFER
U020	SN74LS244N	IC,OCTAL BUFFER
U021	SN74LS244N	IC,OCTAL BUFFER
U022	SN74LS244N	IC,OCTAL BUFFER
U023	CTM5030	IC,CPU (8051AH)
U024	MSM6242BRS	IC,TIMER
U025	PST518B	IC,RESET
U026	TA79L012P	IC,VOLTAGE REGULATOR (-12V)
U101	HD74HC02P	IC,QUAD 2 INPUT NOR GATE
VR001	R12-1538-05	RES. SEMI FIXED 1KB
VR101	S29-1503-05	ROTARY SWITCH (WITH V.R.)
X001	L78-0107-05	CERAMIC RESONATOR (10MHZ)
X02A	L77-1025-05	CRYSTAL RESONATOR (32.768KHZ)
X02B	L77-1299-05	CRYSTAL (SUB L77-1025-05)

LINE FILTER UNIT

X80-1060-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	E01-0103-05	CRT SOCKET
	J25-5179-13	P.C.B.(UNMOUNTED)
	L33-0808-05	CHOKE COIL
	R92-0150-05	JUMPING RES. ZERO OHM
C001	C91-0575-05	CAP. CERAMIC 1000P. 630V
C002	C91-0575-05	CAP. CERAMIC 1000P 630V
C003	C91-0551-05	CAP. POLYESTER 0.22 10% 630V
C010	CC45CH2H010C	CAP. CERAMIC 1P 0.25P 500V
J042	E31-2841-05	WIRE ASS'Y (+Y,-Y)
J043	E31-2842-05	WIRE ASS'Y (+X,-X)
J044	E31-2843-05	WIRE ASS'Y (P1,G1,K,H)
J045	NO USE	
J046	E31-2844-05	WIRE ASS'Y (P2,G2)
P030	E40-0474-05	PIN CONNECTOR 4P
P050	E40-0474-05	PIN CONNECTOR 4P
P051	NO USE	
P052	E40-0474-05	PIN CONNECTOR 4P
P069	E40-0530-05	PIN CONNECTOR 5P
P073	E40-0330-05	PIN CONNECTOR 3P
R001	RD14BY2H225J	RES. CARBON 2.2M 5% 1/2W
R002	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R003	RD14BB2C101J	RES. CARBON 100 5% 1/6W
S001	S40-2524-05	PUSH SWITCH (POWER)
VR001	R23-3502-05	V.R. (INTEN) 20KB X 2
VR002	R23-7501-05	V.R. (FOCUS,ASTIG) 500KB X 2
VR003	R23-3503-05	V.R. (ILLUM,ROTAT) 20KB X 2

PARTS LIST

FINAL UNIT

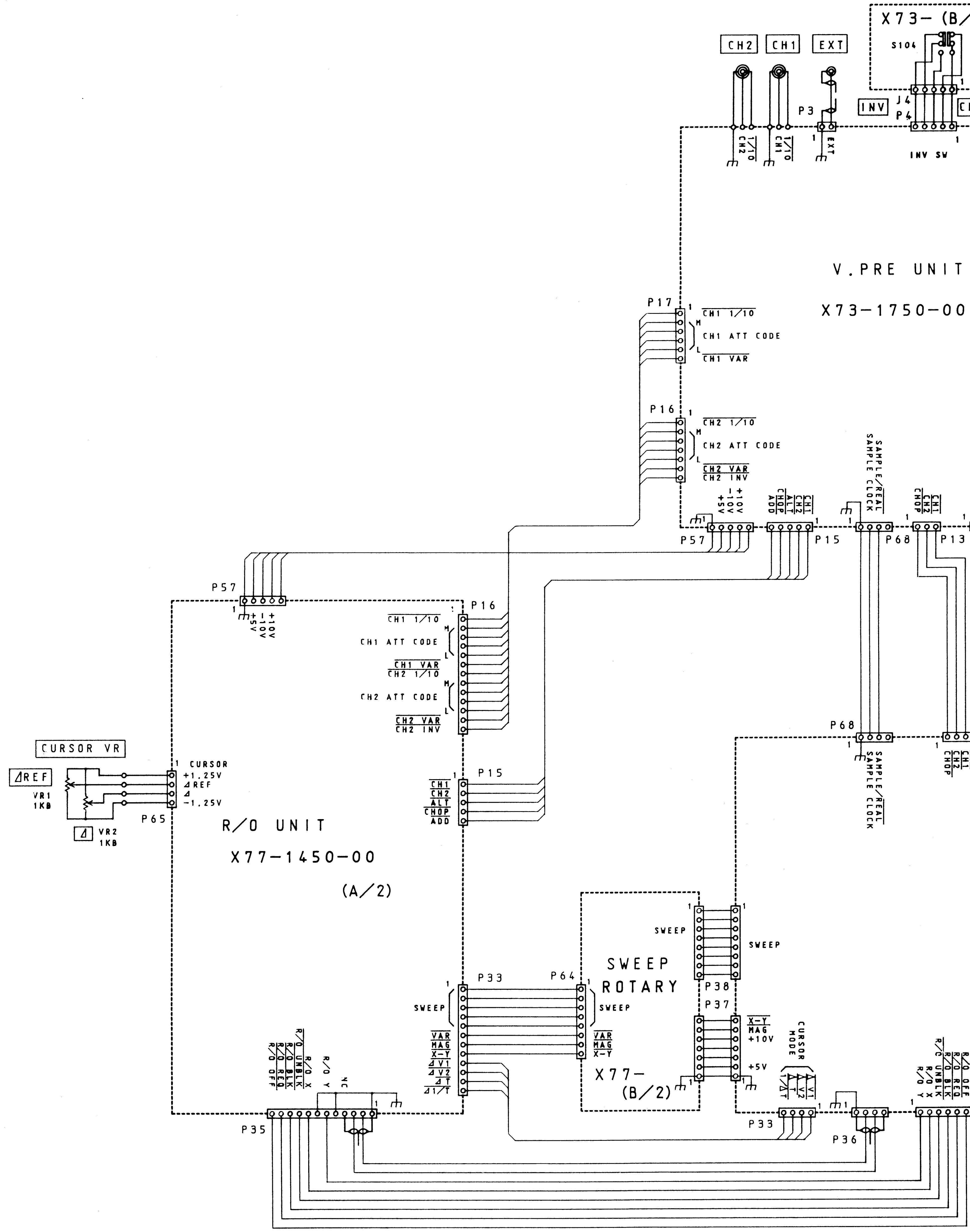
X80-1090-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	F01-0859-04	HEAT SINK			
	F01-0860-04	HEAT SINK			
	J25-5183-12	P.C.B. (UNMOUNTED)			
	N09-0626-04	SCREW, SEMS	M3X10		
C001	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C002	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C003	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C006	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C007	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C008	NO USE				
C009	CC45FCH1H390J	CAP. CERAMIC	39P	5%	50V
C010	NO USE				
C011	CC45FCH1H151J	CAP. CERAMIC	150P	5%	50V
C012	NO USE				
C013	CK45FE2H472P	CAP. CERAMIC	4700P		500V
C014	CK45FE2H472P	CAP. CERAMIC	4700P		500V
C019	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C020	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C021	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C022	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C023	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C028	C91-1232-05	CAP. CERAMIC	5.6P	10%	50V
C029	CC45FCH2H010C	CAP. CERAMIC	1P	0.25P	500V
C030	CC45FCH2H010C	CAP. CERAMIC	1P	0.25P	500V
C031	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C032	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C033	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C034	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C035	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C039	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C040	NO USE				
C041	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C045	CE04EW1C471M	CAP. ELECTRO	470	20%	16V
C046	CE04EW1C471M	CAP. ELECTRO	470	20%	16V
C047	CE04EW2A470M	CAP. ELECTRO	47	20%	100V
C048	CE04W2C100M	CAP. ELECTRO	10	20%	160V
C049	CK45FE2H472P	CAP. CERAMIC	4700P		500V
C050	CE04EW0J682M	CAP. ELECTRO	6800	20%	6.3V
C051	CE04EW0J682M	CAP. ELECTRO	6800	20%	6.3V
C052	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C053	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C054	NO USE				
C055	CC45FSL1H471J	CAP. CERAMIC	470P	5%	50V
C056	NO USE				
C057	CQ92FM1H102K	CAP. MYLAR	1000P	10%	50V
C058	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C059	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C901	CC45FCH1H050C	CAP. CERAMIC	5P	0.25P	50V
C902	CC45FCH1H150J	CAP. CERAMIC	15P	5%	50V
C903	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
D001	MA700	DIODE			
D002	MA700	DIODE			
D003	MA700	DIODE			
D004	1SS132	DIODE			
D005	MA700	DIODE			
D006	MA700	DIODE			
D007	1SS132	DIODE			
D008	1SS132	DIODE			
D009	1SS132	DIODE			
D010	1SS132	DIODE			
D011	MA700	DIODE			
D012	1SS132	DIODE			
D013	1SS132	DIODE			
D014	1SS132	DIODE			
D015	1SS132	DIODE			
D016	1SS132	DIODE			
D017	1SS132	DIODE			
D018	1SS132	DIODE			
D019	1SS132	DIODE			
D020	1SS132	DIODE			
D021	1SS132	DIODE			
L001	L40-4782-70	FERRI INDUCTOR	0.47UF		
L002	L40-6882-70	FERRI INDUCTOR	0.68UF		
L003	L40-6882-70	FERRI INDUCTOR	0.68UF		
L004	L40-4782-70	FERRI INDUCTOR	0.47UF		
P008	E40-0473-05	PIN CONNECTOR	4P		
REF.NO	PARTS NO	NAME & DESCRIPTION			
P024	E40-0873-05	PIN CONNECTOR	8P		
P041	E40-0673-05	PIN CONNECTOR	6P		
P042	E40-0373-05	PIN CONNECTOR	3P		
P043	E40-0373-05	PIN CONNECTOR	3P		
Q001	2SA1206(K)	TR. SI. PNP			
Q002	2SA1206(K)	TR. SI. PNP			
Q003	2SC3354(S)	TR. SI. NPN			
Q004	2SC3354(S)	TR. SI. NPN			
Q005	2SC3354(S)	TR. SI. NPN			
Q006	2SC3354(S)	TR. SI. NPN			
Q007	2SC3354(S)	TR. SI. NPN			
Q008	2SC3354(S)	TR. SI. NPN			
Q009	2SC3354(S)	TR. SI. NPN			
Q010	2SC3354(S)	TR. SI. NPN			
Q011	2SC3779(D)	TR. SI. NPN			
Q012	NO USE				
Q013	2SC3779(D)	TR. SI. NPN			
Q014	NO USE				
Q015	2SC3596(E)	TR. SI. NPN			
Q016	2SC3596(E)	TR. SI. NPN			
Q017	2SC3315(D)	TR. SI. NPN			
Q018	2SC3315(D)	TR. SI. NPN			
Q019	2SA1005(K)	TR. SI. PNP			
Q020	2SA1005(K)	TR. SI. PNP			
Q023	2SC2785(F)	TR. SI. NPN			
Q024	2SC2785(F)	TR. SI. NPN			
Q025	2SC3354(S)	TR. SI. NPN			
Q026	2SC3354(S)	TR. SI. NPN			
Q027	2SC3354(S)	TR. SI. NPN			
Q028	2SC3354(S)	TR. SI. NPN			
Q029	2SA1175(F)	TR. SI. PNP			
Q030	2SA1175(F)	TR. SI. PNP			
Q031	2SC2785(F)	TR. SI. NPN			
Q032	2SC2785(F)	TR. SI. NPN			
Q033	2SC3354(S)	TR. SI. NPN			
Q034	2SC3354(S)	TR. SI. NPN			
Q035	2SC3354(S)	TR. SI. NPN			
Q036	2SC3354(S)	TR. SI. NPN			
Q037	2SC2911(S)	TR. SI. NPN			
Q038	2SA1209(S)	TR. SI. PNP			
Q039	2SC2911(S)	TR. SI. NPN			
Q040	2SA1209(S)	TR. SI. PNP			
Q041	NO USE				
Q042	2SA1005(K)	TR. SI. PNP			
Q043	2SA1005(K)	TR. SI. PNP			
Q044	2SC2786(K)	TR. SI. NPN			
Q045	2SC2786(K)	TR. SI. NPN			
Q046	NO USE				
Q047	2SC3315(D)	TR. SI. NPN			
Q048	2SC3315(D)	TR. SI. NPN			
Q049	2SC2785(F)	TR. SI. NPN			
Q050	2SA1005(K)	TR. SI. PNP			
Q051	2SC2785(F)	TR. SI. NPN			
R001	RN14BK2C47R0F	RES. METAL FILM	47.0	1%	1/6W
R002	RN14BK2C47R0F	RES. METAL FILM	47.0	1%	1/6W
R003	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R004	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R005	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R006	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R007	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R008	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R009	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R010	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R011	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R012	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R013	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R014	RD14BB2E470J	RES. CARBON	47	5%	1/4W
R015	RD14BB2E470J	RES. CARBON	47	5%	1/4W
R016	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R017	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R018	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R019	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R020	NO USE				
R021	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R022	RD14BB2C433J	RES. CARBON	43K	5%	1/6W
R023	NO USE				
R024	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R025	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R026	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R027	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R028	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R029	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R030	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R031	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W

PARTS LIST

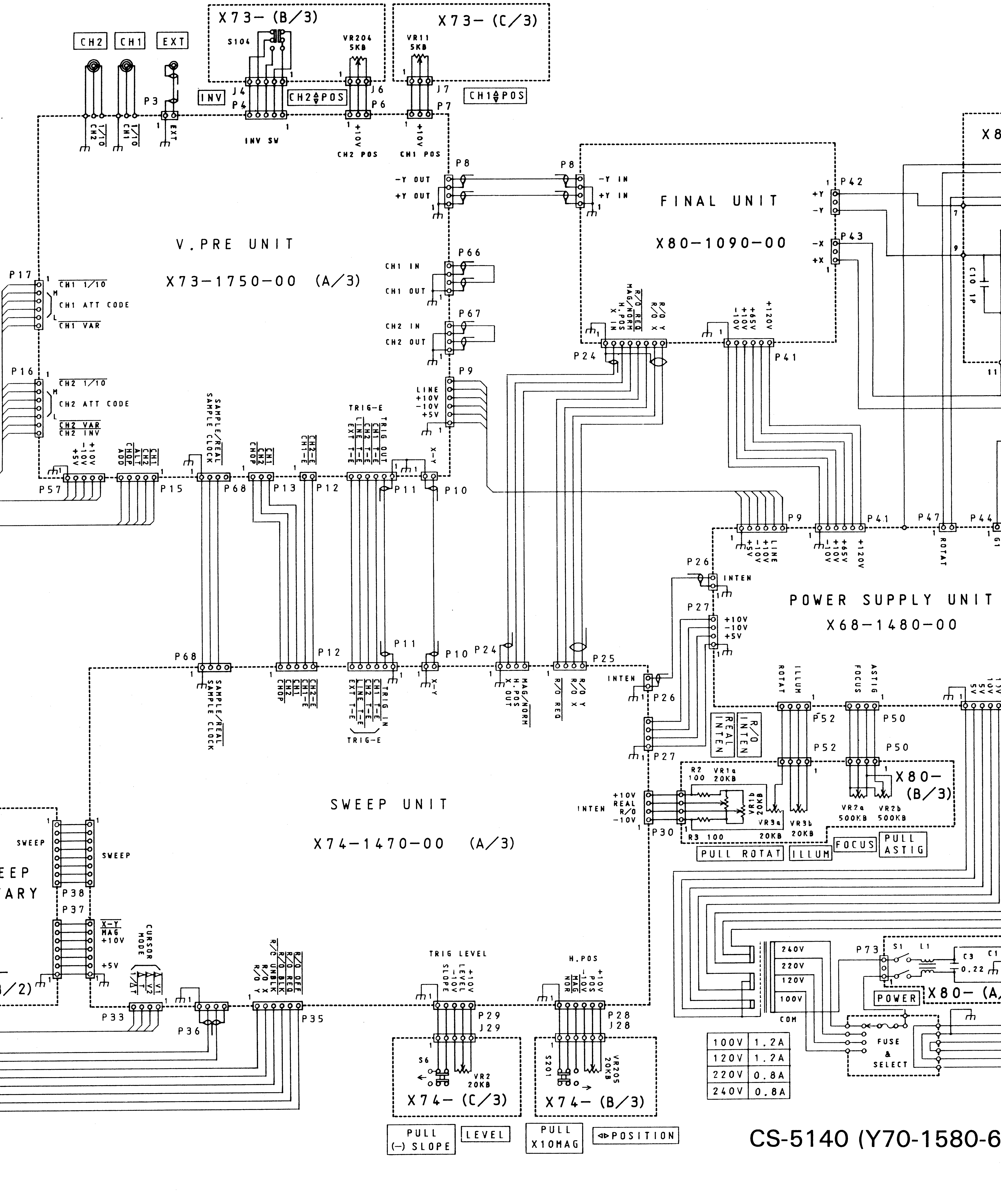
REF.NO	PARTS NO	NAME & DESCRIPTION			
R032	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R033	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R034	NO USE				
R035	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R036	NO USE				
R037	RN14BK2E62R0F	RES. METAL FILM	62.0	1%	1/4W
R038	RN14BK2E62R0F	RES. METAL FILM	62.0	1%	1/4W
R039	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R042	RD14BB2C430J	RES. CARBON	43	5%	1/6W
R043	NO USE				
R044	RD14BB2C203J	RES. CARBON	20K	5%	1/6W
R045	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R046	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R047	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R048	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R049	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R050	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R051	R92-1411-05	RES. SPR5L30	1.2K	5%	
R052	R92-1412-05	RES. SPR5L30	1.8K	5%	
R053	R92-1412-05	RES. SPR5L30	1.8K	5%	
R054	R92-1411-05	RES. SPR5L30	1.2K	5%	
R060	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R078	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R079	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R080	RD14BB2C112J	RES. CARBON	1.1K	5%	1/6W
R081	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R082	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R083	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R084	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R087	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R088	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R089	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R090	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R091	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R092	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R093	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R094	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R095	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R096	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R097	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R098	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R099	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R100	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R101	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R102	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R103	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R104	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R105	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R106	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R107	RN14BK2C1101F	RES. METAL FILM	1.1K	1%	1/6W
R108	RN14BK2C1101F	RES. METAL FILM	1.1K	1%	1/6W
R109	NO USE				
R110	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R111	RD14BB2C364J	RES. CARBON	360K	5%	1/6W
R112	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R113	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R114	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R115	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R116	RN14BK2H3902F	RES. METAL FILM	39K	1%	1/2W
R117	RN14BK2H3902F	RES. METAL FILM	39K	1%	1/2W
R118	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R119	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R120	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R121	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R122	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R123	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R124	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R125	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R126	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R127	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R128	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R129	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R130	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R131	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R132	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R150	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R156	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R157	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R160	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R161	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R162	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R163	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R164	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R165	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R166	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R167	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R168	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R169	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R170	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R171	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R172	NO USE				
R173	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R174	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R175	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R176	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R177	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R178	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R179	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R180	RD14BB2C163J	RES. CARBON	16K	5%	1/6W
R181	RN14BK2C1301F	RES. METAL FILM	1.3K	1%	1/6W
R182	RD14BB2C112J	RES. CARBON	1.1K	5%	1/6W
R183	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R184	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R185	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R186	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R187	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R188	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R189	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R190	NO USE				
R191	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R192	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R193	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R194	NO USE				
R195	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R196	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R197	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R198	RN14BK2C1300F	RES. METAL FILM	130	1%	1/6W
R199	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R200	RD14BB2C911J	RES. CARBON	910	5%	1/6W
R201	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R202	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R203	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R204	NO USE				
R205	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R206	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R207	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R208	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R209	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R210	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R211	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R212	RN14BK2C1301F	RES. METAL FILM	1.3K	1%	1/6W
R213	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R901	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R902	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R903	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
TC001	C05-0445-05	CAP. TRIMMER	20P		
TC002	C05-0449-05	CAP. TRIMMER	100P		
TC003	NO USE				
TC004	C05-0445-05	CAP. TRIMMER	20P		
TH001	SDT20	THERMISTOR			
TH002	NO USE				
TH003	SDT1000	THERMISTOR			
TH004	SDT100	THERMISTOR			
VR001	R12-1539-05	RES. SEMI FIXED	2KB		
VR002	R12-0569-05	RES. SEMI FIXED	100B		
VR003	R12-0571-05	RES. SEMI FIXED	500B		
VR004	R12-1538-05	RES. SEMI FIXED	1KB		
VR005	R12-0569-05	RES. SEMI FIXED	100B		
VR006	R12-4416-05	RES. SEMI FIXED	50KB		
VR007	R12-0570-05	RES. SEMI FIXED	200B		
VR008	R12-0569-05	RES. SEMI FIXED	100B		
VR009	R12-0570-05	RES. SEMI FIXED	200B		
VR010	R12-1538-05	RES. SEMI FIXED	1KB		
VR011	R12-0571-05	RES. SEMI FIXED	500B		

SCHEMATIC



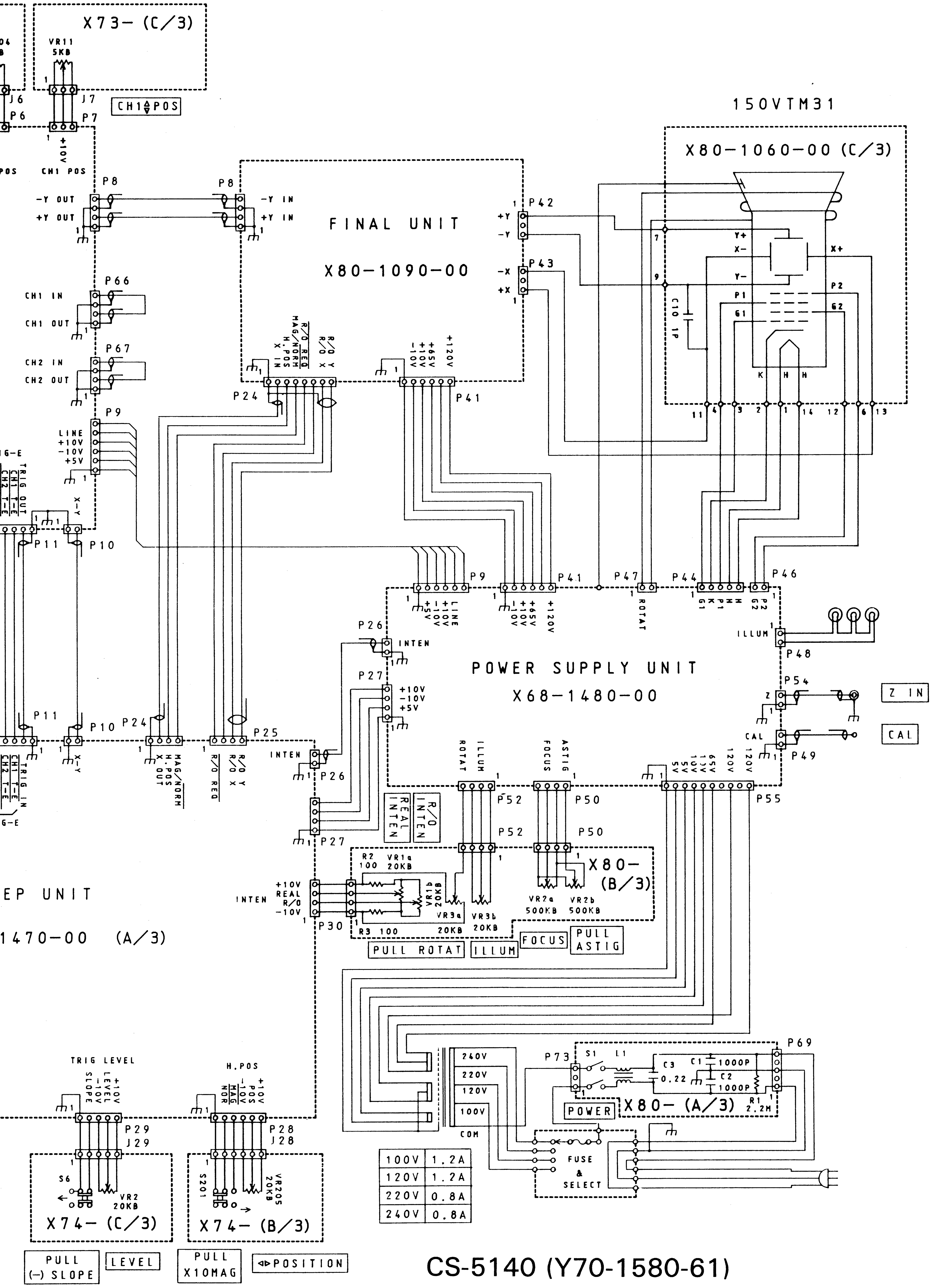
X73- (B/
S104
CH2
CH1
EXT
INV
J4
P4
P3
CH2 1/10
CH1 1/10
EXT
INV SW
V.PRE UNIT
X73-1750-00
P17
CH1 1/10
CH1 ATT CODE
CH1 VAR
P16
CH2 1/10
CH2 ATT CODE
CH2 VAR
CH2 INV
+5V
+10V
-10V
CHOP
ADD
CH1
CH2
ALT
SAMPLE/REAL
SAMPLE CLOCK
P57
P15
P68
P13
P57
+5V
+10V
-10V
P16
CH1 1/10
CH1 ATT CODE
CH1 VAR
CH2 1/10
CH2 ATT CODE
CH2 VAR
CH2 INV
P15
CH1
CH2
ALT
CHOP
ADD
CURSOR VR
ΔREF
VR1
1KB
Δ
VR2
1KB
P65
CURSOR
+1.25V
ΔREF
Δ
-1.25V
R/O UNIT
X77-1450-00
(A/2)
P68
SAMPLE/REAL
SAMPLE CLOCK
CH1
CH2
CHOP
SWEEP
SWEEP
P38
P37
SWEEP ROTARY
X77-
(B/2)
P33
P64
SWEEP
SWEEP
VAR
MAG
X-Y
ΔV1
ΔV2
ΔT
Δ1/T
VAR
MAG
X-Y
X-Y
MAG
+10V
+5V
CURSOR MODE
ΔV1
ΔV2
ΔT
1/ΔT
R/O OFF
R/O REQ
R/O BLK
R/O UNBLK
R/O X
R/O Y
NC
P35
P33
P36
R/O OFF
R/O REQ
R/O UNBLK
R/O X
R/O Y

SCHEMATIC DIAGRAM


X73-(B/3)
X73-(C/3)
CH2
CH1
EXT
S104
VR204 5KB
VR11 5KB
INV
CH2 POS
CH1 POS
INV SW
+10V
P3
P4
J4
J6
P6
J7
P7
P8
-Y OUT
+Y OUT
-Y IN
+Y IN
FINAL UNIT
X80-1090-00
P42
P43
+Y
-Y
-X
+X
C10 1P
V.PRE UNIT
X73-1750-00 (A/3)
P17
CH1 1/10
CH1 ATT CODE
CH1 VAR
P16
CH2 1/10
CH2 ATT CODE
CH2 VAR
CH2 INV
P66
CH1 IN
CH1 OUT
P67
CH2 IN
CH2 OUT
P9
LINE
+10V
-10V
+5V
P24
R/O Y
R/O X
R/O REG
MAG/NORM
H.POS
X IN
P41
+120V
+65V
+10V
-10V
P57
P15
P68
SAMPLE/REAL
SAMPLE CLOCK
CHOP
ADD
ALT
P13
P12
CH2-E
CH1-E
TRIG-E
TRIG OUT
EXT T-E
LINE T-E
CH2 T-E
CH1 T-E
P11
P10
X-Y
P47
P44
ROTAT
POWER SUPPLY UNIT
X68-1480-00
P26
INTEN
P27
P25
P52
P50
ILLUM
FOCUS
ASTIG
REAL INTEN
R/O INTEN
R2 100
VR1a 20KB
VR1b 20KB
VR3a 20KB
VR3b 20KB
R3 100
P30
REAL
R/O
VR2a 500KB
VR2b 500KB
X80-(B/3)
PULL ROTAT
ILLUM
FOCUS
PULL ASTIG
SWEEP UNIT
X74-1470-00 (A/3)
SWEEP
P38
P37
X-Y
MAG
CURSOR MODE
P33
P36
P35
R/O OFF
R/O BLK
UNBLK
TRIG LEVEL
SLOPE
LEVEL
P29
J29
S6
VR2 20KB
X74-(C/3)
H.POS
POS
NOR
P28
J28
S201
VR205 20KB
X74-(B/3)
PULL (-) SLOPE
LEVEL
PULL X10MAG
POSITION
240V
220V
120V
100V
COM
P73
S1
L1
C3
0.22
POWER
X80-(A
FUSE & SELECT
100V 1.2A
120V 1.2A
220V 0.8A
240V 0.8A

CS-5140 (Y70-1580-6

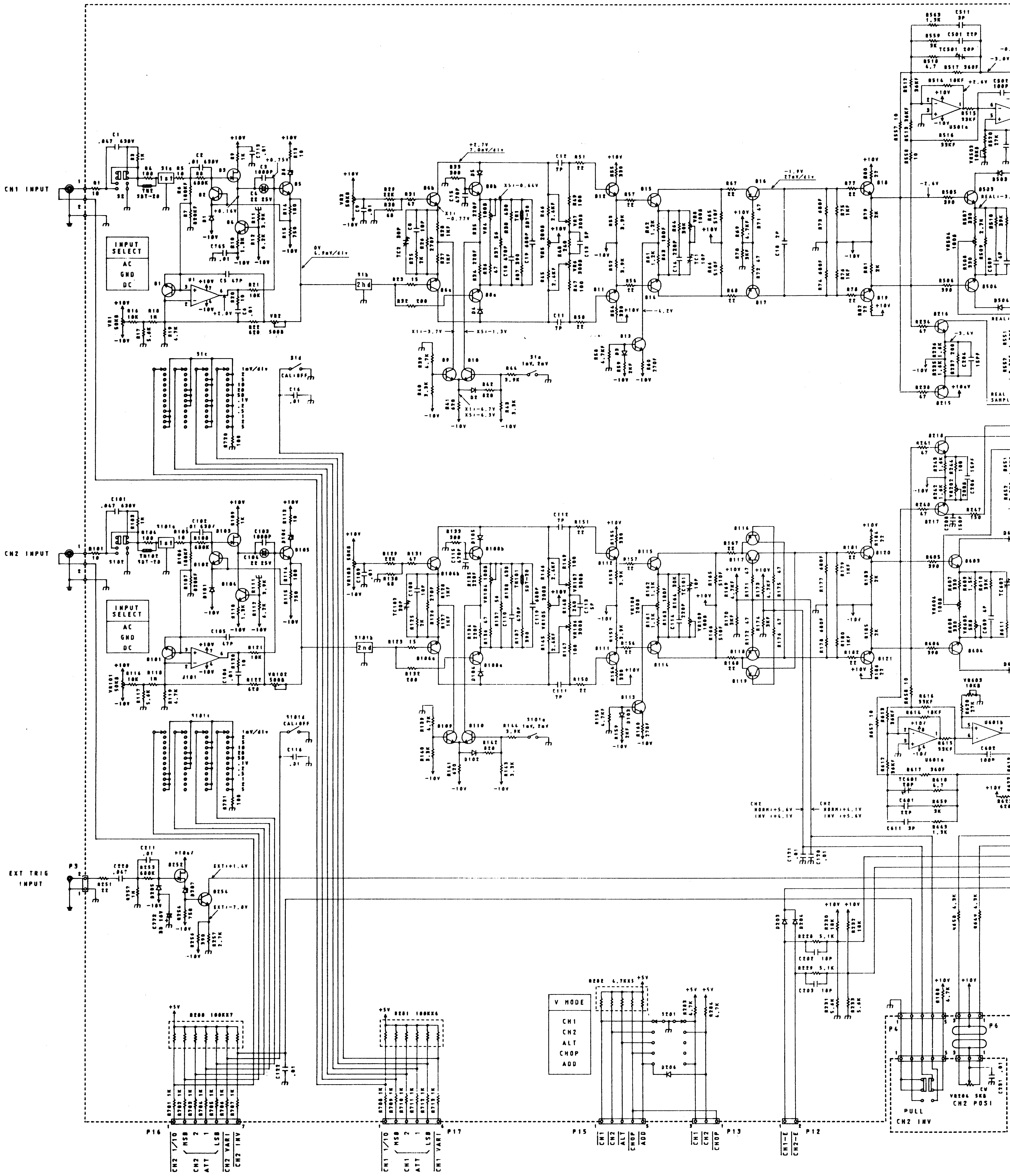
RAM


X73- (C/3)
VR11
5KB
J6
P6
J7
P7
CH1 POS
+10V
CH1 POS
P8
-Y OUT
+Y OUT
-Y IN
+Y IN
FINAL UNIT
X80-1090-00
P42
+Y
-Y
P43
-X
+X
R/O REG
MAG/NORM
H.POS
X IN
R/O Y
R/O X
-10V
+10V
+65V
+120V
P24
P41
150VTM31
X80-1060-00 (C/3)
Y+
X-
X+
Y-
P1
P2
G1
G2
K
H
C10 1P
P66
CH1 IN
CH1 OUT
P67
CH2 IN
CH2 OUT
P9
LINE
+10V
-10V
+5V
TRIG OUT
CH1 T-E
CH2 T-E
X-Y
P11
P10
P9
P41
P47
P44
P46
ROTAT
ILLUM
P48
POWER SUPPLY UNIT
X68-1480-00
P26
INTEN
P27
+10V
-10V
+5V
P54
Z
Z IN
CAL
P49
CAL
P24
X OUT
P25
R/O REG
TRIG IN
EP UNIT
1470-00 (A/3)
ROTAT
ILLUM
FOCUS
ASTIG
5V
10V
65V
120V
P52
P50
P55
REAL INTEN
R/O INTEN
R2 100
VR1a 20KB
VR1b 20KB
VR3a
VR3b 20KB
R3 100
X80- (B/3)
VR2a 500KB
VR2b 500KB
PULL ROTAT
ILLUM
FOCUS
PULL ASTIG
INTEN
REAL
R/O
P30
240V
220V
120V
100V
COM
P73
S1
L1
C3 0.22
C1 1000P
C2 1000P
R1 2.2M
P69
POWER
X80- (A/3)
FUSE & SELECT
100V 1.2A
120V 1.2A
220V 0.8A
240V 0.8A
TRIG LEVEL
LEVEL
SLOPE
P29
J29
S6
VR2 20KB
X74- (C/3)
H.POS
POS
MAG
NOR
P28
J28
S201
VR205 20KB
X74- (B/3)
PULL (-) SLOPE
LEVEL
PULL X10MAG
POSITION

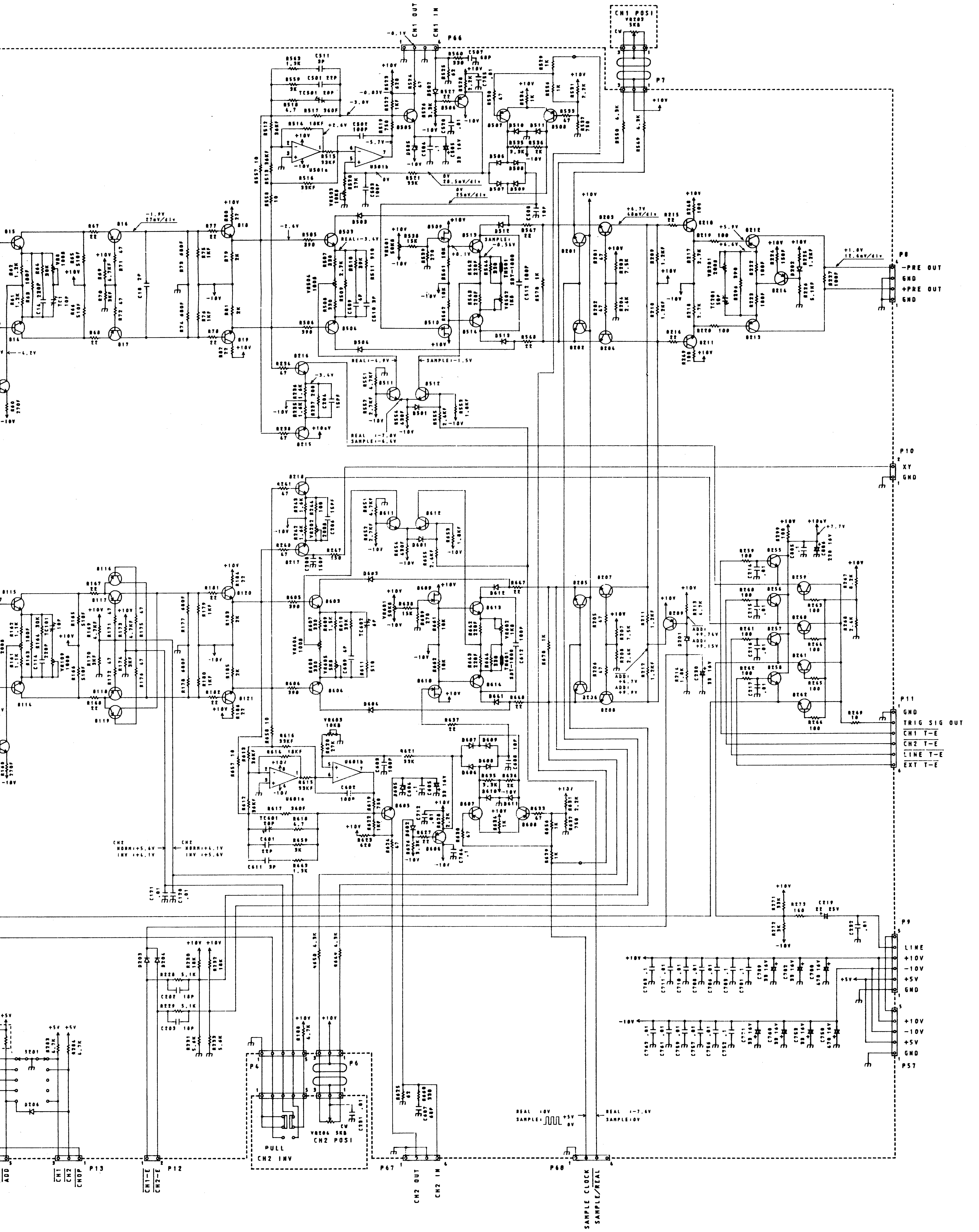
CS-5140 (Y70-1580-61)

SCHEMATIC DIA

V.PRE UNIT (X73-1750-00)


CH1 INPUT
INPUT SELECT
AC
GND
DC
CH2 INPUT
INPUT SELECT
AC
GND
DC
EXT TRIG INPUT
P3
CAL/OFF
1mV/div
V MODE
CH1
CH2
ALT
CHOP
ADD
P16
CH2 1/10
MSB
2
1
LSB
CH2 ATT
CH2 VARI
CH2 INV
P17
CH1 1/10
MSB
2
1
LSB
CH1 ATT
CH1 VARI
P15
CH1
CH2
ALT
CHOP
ADD
P13
CH1
CH2
CHOP
P12
CH1-E
CH2-E
P4
P6
PULL
CH2 INV
VR204 5KB
CH2 POSI

SCHEMATIC DIAGRAM

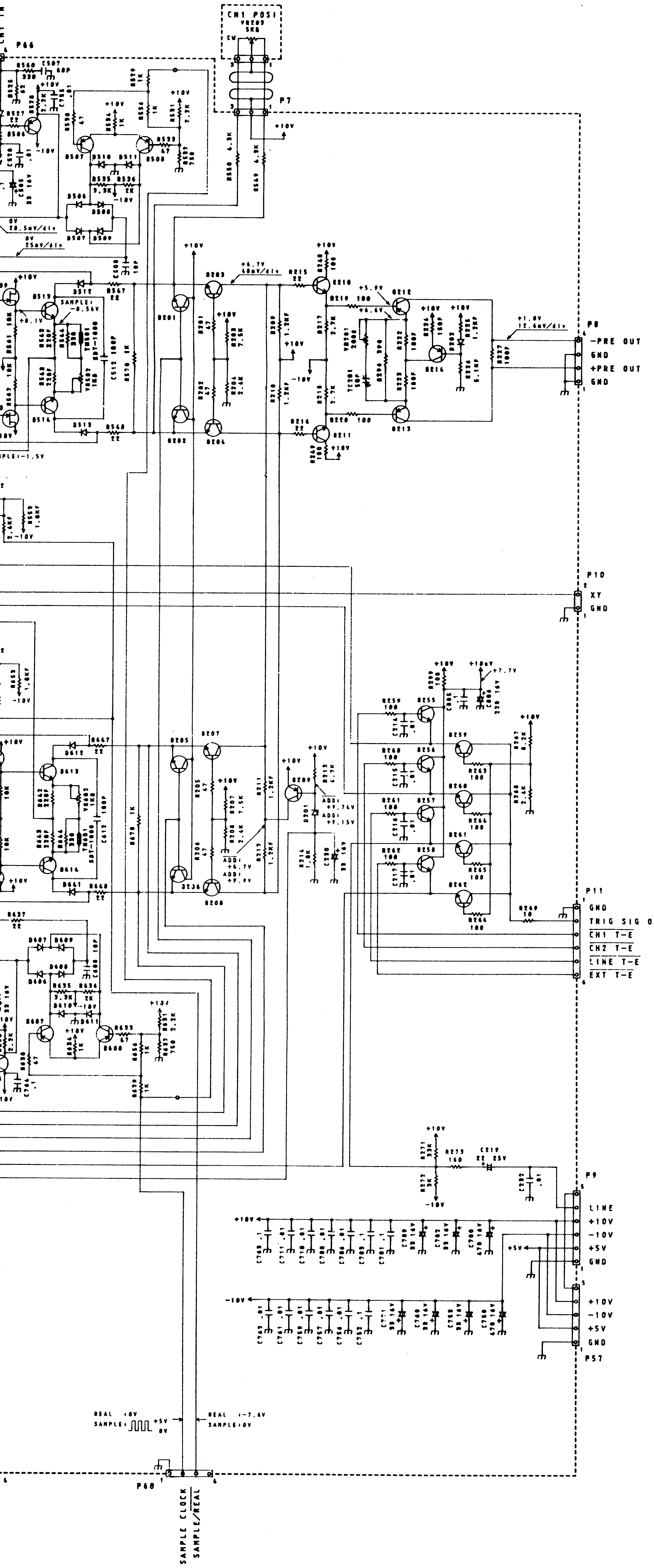

CH1 OUT
CH1 IN
P66
CH1 POSI
VR203 5KB
P7
P8
-PRE OUT
GND
+PRE OUT
GND
P10
XY
GND
P11
GND
TRIG SIG OUT
CH1 T-E
CH2 T-E
LINE T-E
EXT T-E
P9
LINE
+10V
-10V
+5V
GND
P57
ADD
CH1
CH2
CHOP
P13
CH1-E
CH2-E
P12
P4
P6
PULL
CH2 INV
VR206 5KB
CH2 POSI
P67
CH2 OUT
CH2 IN
P68
SAMPLE CLOCK
SAMPLE/REAL
U501a
U501b
U601a
U601b

Q1, 2, 4, 9, 10,
101, 102, 10
110, 113, 20
207, 208, 21
215~218, 25
259~262, 50
603, 604
Q3, 103, 252
Q5, 11, 12, 14,
18, 19, 105,
112, 114, 11
121, 505, 60
Q6, 106
Q8, 108
Q16, 17, 116~
212, 213, 50
606~608
Q201, 202, 20
255~258, 51
611~614
Q209, 214
Q509, 510, 60

D1, 2, 3, 101,
103, 202~20
501~504, 60
D4, 5, 104, 10
506~513, 60
D6, 106
D201, 207, 50

U1, 101
U501, 601

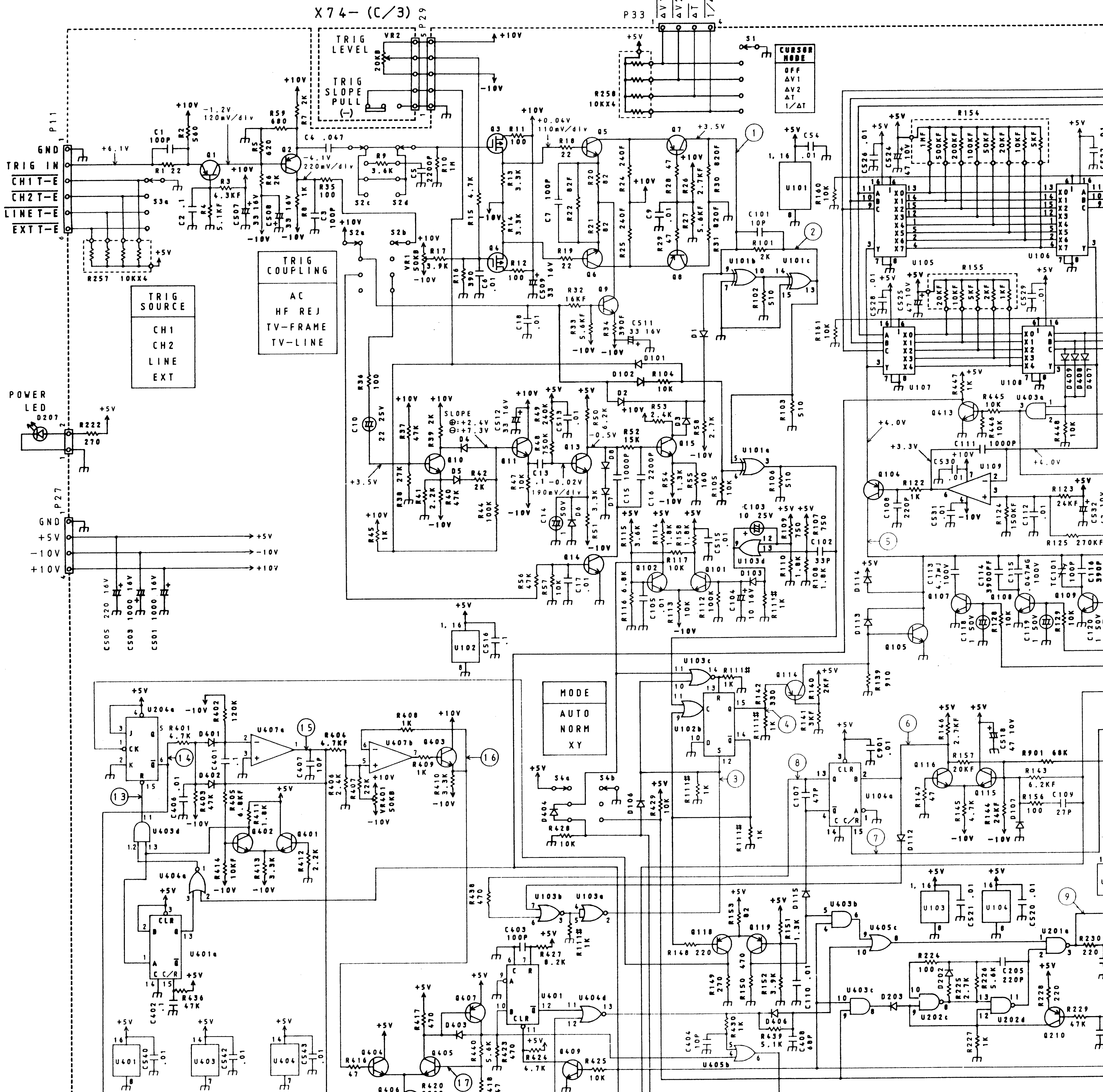
M


CN1 POSI
P7
P8
-PRE OUT
GND
+PRE OUT
GND
P10
XY
GND
P11
GND
TRIG SIG OUT
CH1 T-E
CH2 T-E
LINE T-E
EXT T-E
P9
LINE
+10V
-10V
+5V
GND
+10V
-10V
+5V
GND
P57
P66
P68
SAMPLE CLOCK
SAMPLE/REAL

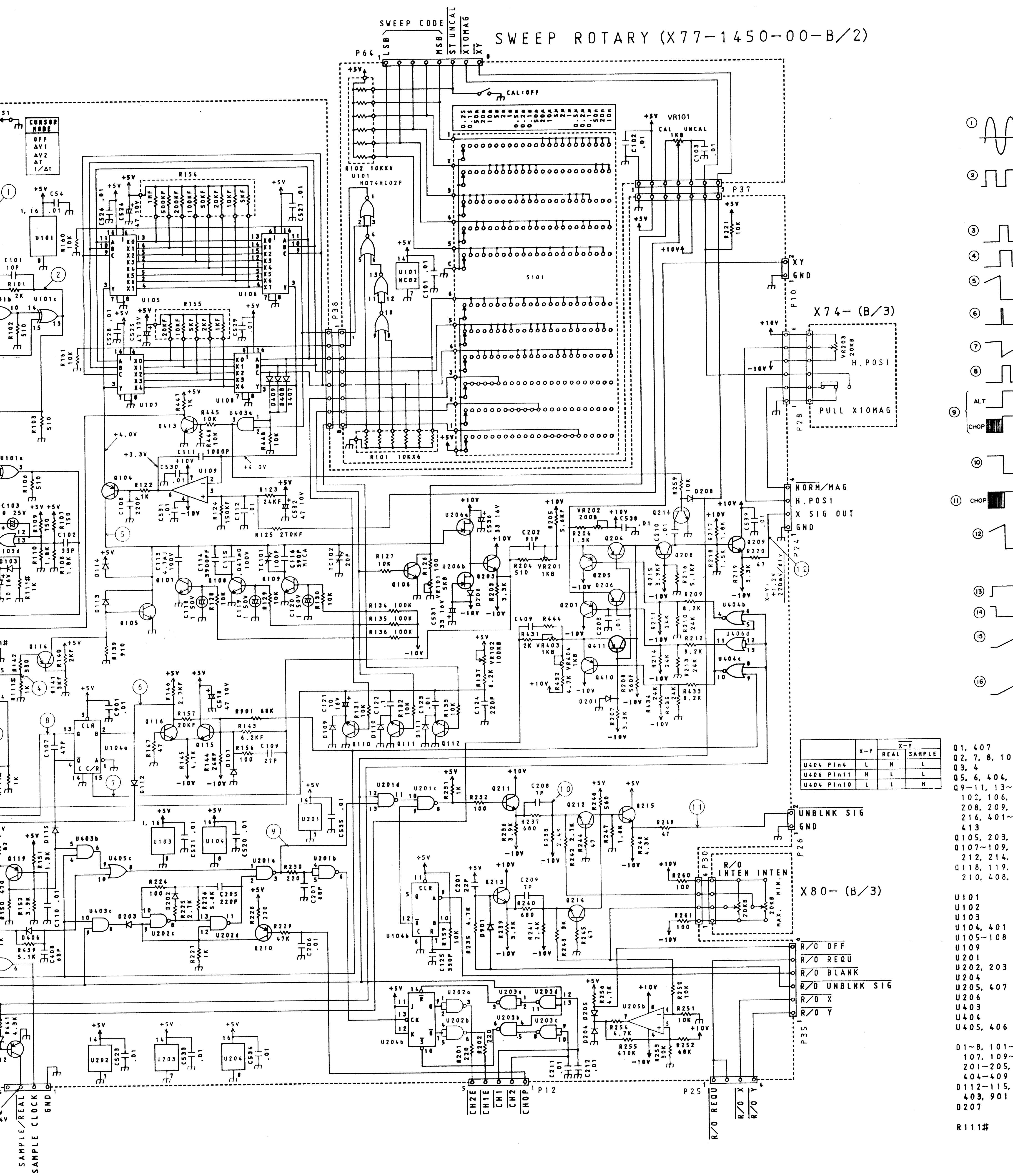
Q1, 2, 4, 9, 10, 13, 101, 102, 104, 109, 110, 113, 203, 204, 207, 208, 210, 211, 215~218, 254, 259~262, 503, 504, 603, 604	: C3354 (S, T)
Q3, 103, 252	: K404 (F)
Q5, 11, 12, 14, 15, 18, 19, 105, 111, 112, 114, 115, 120, 121, 505, 605	: C2671 (H)
Q6, 106	: C4072
Q8, 108	: C3381 (GR)
Q16, 17, 116~119, 212, 213, 506~508, 606~608	: A1206 (K)
Q201, 202, 205, 206, 255~258, 511~514, 611~614	: C2785 (F)
Q209, 214	: A1005 (K)
Q509, 510, 609, 610	: K117 (Y)
D1, 2, 3, 101, 102, 103, 202~206, 501~504, 601~604,	: 1SS132
D4, 5, 104, 105, 506~513, 606~613	: MA700
D6, 106	: MTZ5.1JB
D201, 207, 505, 605	: MTZ6.2JB
U1, 101	: LF411CN
U501, 601	: NJM4558D

SCHEMATIC

SWEEP UNIT (X74-1470-00-A/3)

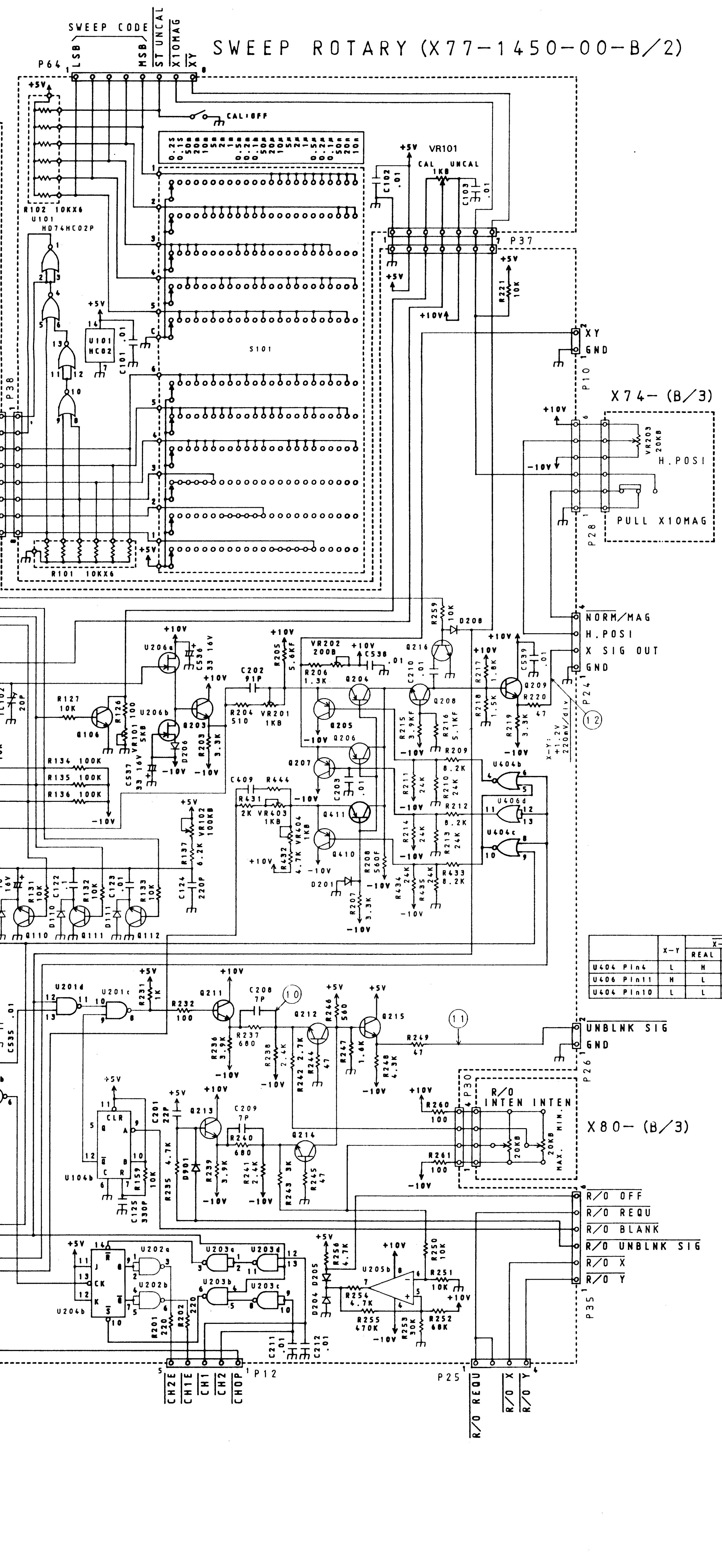

X74- (C/3)
P29
TRIG LEVEL
VR2 20KB
TRIG SLOPE PULL (−)
P33
ΔV1
ΔV2
ΔT
1/ΔT
CURSOR MODE
OFF
ΔV1
ΔV2
ΔT
1/ΔT
S1
R250 10KX4
P11
GND
TRIG IN
CH1T-E
CH2T-E
LINET-E
EXTT-E
R257 10KX4
TRIG SOURCE
CH1
CH2
LINE
EXT
TRIG COUPLING
AC
HF REJ
TV-FRAME
TV-LINE
POWER LED
D207
R222 270
P27
GND
+5V
−10V
+10V
C505 220 16V
C503 1000 16V
C501 1000 16V
U101
U102
U105
U106
U107
U108
U109
R154
R155
MODE
AUTO
NORM
XY
U204a
U407a
U407b
U401a
U404a
U403d
U401
U403
U404
U405
U406
U103c
U102b
U104a
U103b
U103a
U403b
U405c
U403c
U405b
U201a
U202c
U202d
U103
U104
U202
U203
U204
P36
GND
P68
SAMPLE: −7.6V
REAL : −0.04V
SAMPLE/REAL
SAMPLE CLOCK
GND

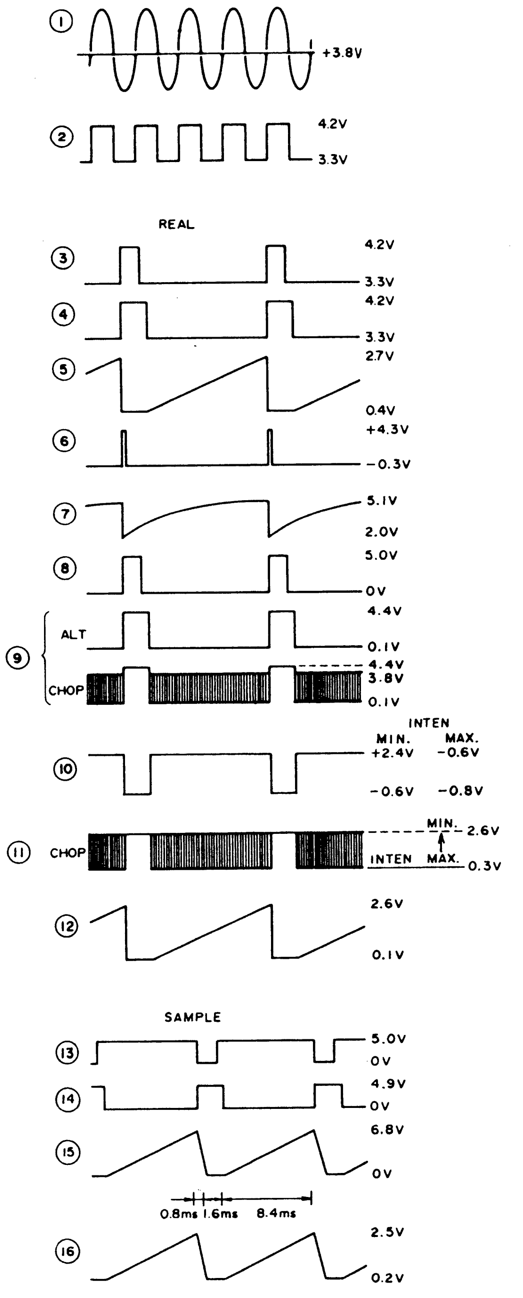
SCHEMATIC DIAGRAM


SWEEP ROTARY (X77-1450-00-B/2)
SWEEP CODE
LSB
MSB
ST UNCAL
X10MAG
XY
P64
CAL·OFF
VR101
CAL UNCAL
S101
P37
P38
R101 10KX6
R102 10KX6
U101 HD74HC02P
CURSOR MODE
OFF
ΔV1
ΔV2
ΔT
1/ΔT
R154
R155
U105
U106
U107
U108
U109
D407 D408 D409
XY
GND
P10
X74- (B/3)
VR203 20KB
H.POSI
PULL X10MAG
P28
NORM/MAG
H.POSI
X SIG OUT
GND
P24
X-Y: +1.2V 220mV/div
UNBLNK SIG
GND
P26
X80- (B/3)
P30
R/O INTEN INTEN
MIN. MAX.
R/O OFF
R/O REQU
R/O BLANK
R/O UNBLNK SIG
R/O X
R/O Y
P35
P25
R/O REQU
R/O X
R/O Y
P12
CH2E
CH1E
CH1
CH2
CHOP
SAMPLE/REAL
SAMPLE CLOCK
GND
+4.0V
+3.3V
U201
U202
U203
U204
U103
U104
U104a
U104b
U204b
U205b
VR102 100KB
VR201 1KB
VR202 200B
VR403 1KB
VR404 4.7K
ALT
CHOP
Q1, 407
Q2, 7, 8, 10
Q3, 4
Q5, 6, 404,
Q9~11, 13~
102, 106,
208, 209,
216, 401~
413
Q105, 203,
Q107~109,
212, 214,
Q118, 119,
210, 408,
U101
U102
U103
U104, 401
U105~108
U109
U201
U202, 203
U204
U205, 407
U206
U403
U404
U405, 406
D1~8, 101~
107, 109~
201~205,
404~409
D112~115,
403, 901
D207
R111#

	X-Y	$\overline{X-Y}$	
		REAL	SAMPLE
U404 Pin4	L	H	L
U406 Pin11	H	L	L
U404 Pin10	L	L	H

AGRAM


SWEEP CODE
LSB
MSB
ST UNCAL
X10MAG
XY
SWEEP ROTARY (X77-1450-00-B/2)
P64
+5V
CAL:OFF
R102 10KX6
U101 HD74HC02P
U101 HC02
S101
R101 10KX6
P38
+5V VR101
CAL UNCAL
1KB
C102 .01
C103 .01
P37
R221 10K
+10V
XY
GND
P10
X74- (B/3)
+10V
-10V
VR203 20KB
H.POSI
PULL X10MAG
P28
NORM/MAG
H.POSI
X SIG OUT
GND
P24
X-Y: +1.2V 220mV/div
UNBLNK SIG
GND
P26
X80- (B/3)
R/O INTEN INTEN
MIN. MAX.
P30
R/O OFF
R/O REQU
R/O BLANK
R/O UNBLNK SIG
R/O X
R/O Y
P35
P25
R/O REQU
R/O X
R/O Y
P12
CH2E
CH1E
CH1
CH2
CHOP
U206a
U206b
Q203
Q204
Q205
Q206
Q207
Q208
Q209
Q216
Q411
Q410
Q104
Q110
Q111
Q112
Q211
Q212
Q213
Q214
Q215
U201d
U201c
U104b
U202a
U202b
U203a
U203b
U203c
U203d
U204b
U205b
U404b
U404c
U406d
D208
D206
D201
D901
D204
D205
VR202 200B
VR201 1KB
VR403 1KB
VR404 1KB
VR102 100KB
VR101 5KB

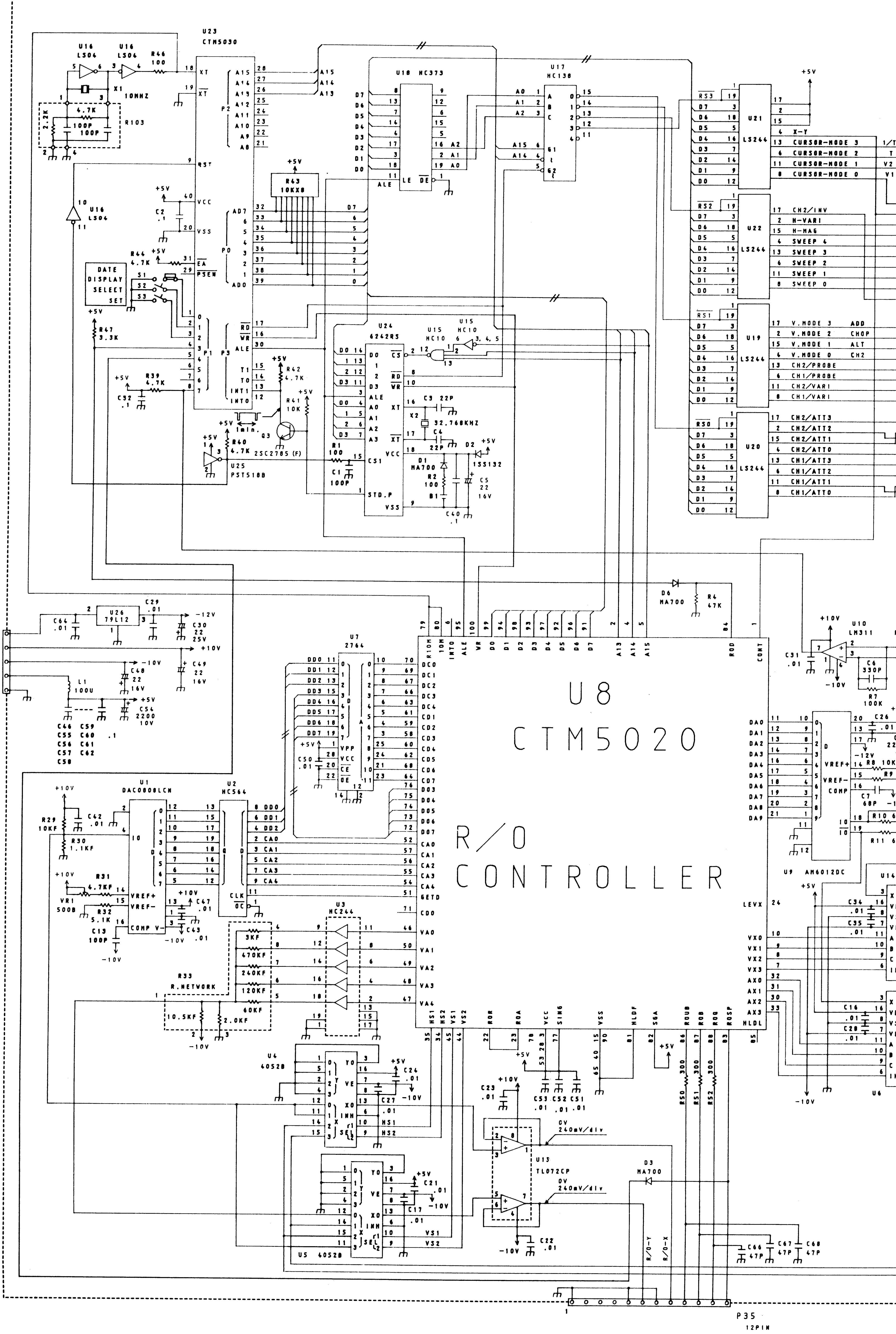


	X-Y	$\overline{X-Y}$	
		REAL	SAMPLE
U404 Pin4	L	H	L
U406 Pin11	H	L	L
U404 Pin10	L	L	H

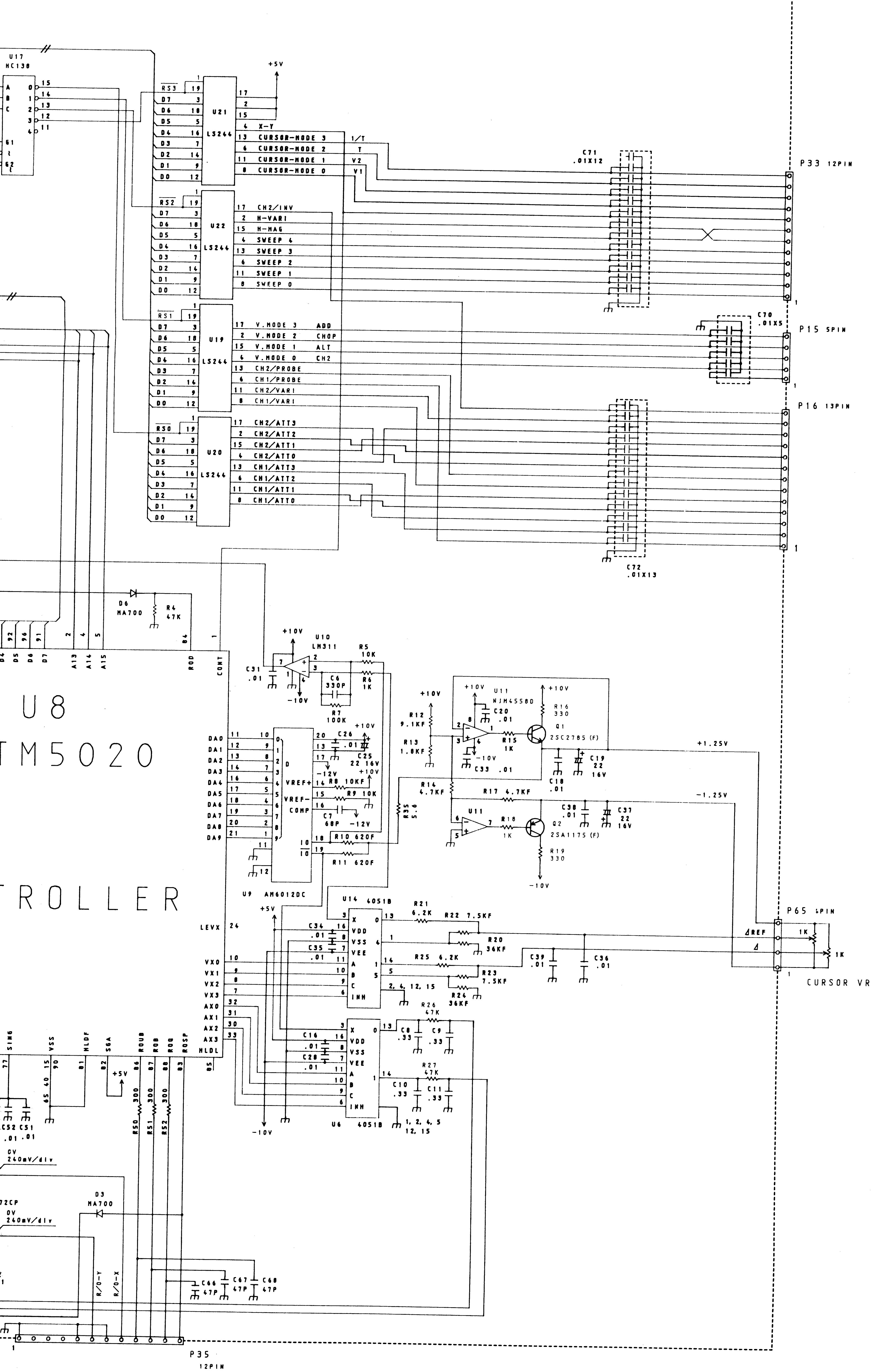
Q1, 407	: A1206 (K)
Q2, 7, 8, 104, 114	: A1005 (K)
Q3, 4	: K241 (Y)
Q5, 6, 404, 405	: C2671 (H)
Q9~11, 13~15, 101, 102, 106, 110~112, 208, 209, 211, 213, 216, 401~403, 409, 413	: C2785 (F)
Q105, 203, 406	: C3354 (S, T)
Q107~109, 115, 116, 212, 214, 215	: C2786 (K)
Q118, 119, 204~207, 210, 408, 410~412	: A1175 (F)
U101	: MC10107L
U102	: MC10H131L
U103	: MC10102L
U104, 401	: TC74HC123P
U105~108	: MC14051BCP
U109	: TL071CP
U201	: SN74ALS00N
U202, 203	: HD74HC00P
U204	: HD74HC112P
U205, 407	: NJM4558D
U206	: 2SK332 (F)
U403	: HD74HC08P
U404	: HD74HC02P
U405, 406	: HD74HC32P
D1~8, 101~103, 106, 107, 109~111, 201~205, 401, 402, 404~409	: 1SS132
D112~115, 206, 208, 403, 901	: MA700
D207	: LN322GPT
R111#	: 1KX8

R/O UNIT (X77-1450-00-A/2)

SCHEMATIC D


U23 CTM5030
U16 LS04
R46 100
X1 10MHZ
R103
4.7K
100P
2.2K
U18 HC373
U17 HC138
U21 LS244
U22 LS244
U19 LS244
U20 LS244
+5V
X-Y
CURSOR-MODE 3
CURSOR-MODE 2
CURSOR-MODE 1
CURSOR-MODE 0
CH2/INV
H-VARI
H-MAG
SWEEP 4
SWEEP 3
SWEEP 2
SWEEP 1
SWEEP 0
V.MODE 3
V.MODE 2
V.MODE 1
V.MODE 0
ADD
CHOP
ALT
CH2
CH2/PROBE
CH1/PROBE
CH2/VARI
CH1/VARI
CH2/ATT3
CH2/ATT2
CH2/ATT1
CH2/ATT0
CH1/ATT3
CH1/ATT2
CH1/ATT1
CH1/ATT0
R43 10KX8
DATE DISPLAY SELECT SET
S1
S2
S3
R44 4.7K
R47 3.3K
R39 4.7K
C92 .1
U24 6242RS
U15 HC10
R42 4.7K
R41 10K
Q3 2SC2785 (F)
R40 4.7K
U25 PST518B
1min.
R1 100
C1 100P
X2 32.768KHZ
C3 22P
C4 22P
D1 MA700
D2 1SS132
R2 100
B1
C5 22 16V
C40 .1
D6 MA700
R4 47K
P57
U26 79L12
C29 .01
C64 .01
C30 22 25V
C49 22 16V
C48 22 16V
L1 100U
C54 2200 10V
C46 C59 C55 C60 C56 C61 C57 C62 C58 .1
+10V
-10V
+5V
-12V
U7 2764
C50 .01
U8 CTM5020
R/O CONTROLLER
U1 DAC0808LCN
R29 10KF
R30 1.1KF
C42 .01
R31 4.7KF
VR1 500B
R32 5.1K
C13 100P
U2 HC564
C47 .01
C43 .01
U3 HC244
R33 R.NETWORK
3KF
470KF
240KF
120KF
60KF
10.5KF
2.0KF
U4 4052B
U5 4052B
C24 .01
C27 .01
C21 .01
C17 .01
U13 TL072CP
0V 240mV/div
C23 .01
C53 C52 C51 .01
C22 .01
D3 MA700
R50 300
R51 300
R52 300
R/O-Y
R/O-X
C66 47P
C67 47P
C68 47P
U10 LM311
C31 .01
C6 330P
R7 100K
C26 .01
R8 10K
R9
C7 68P
R10
R11
U9 AM6012DC
C34 .01
C35 .01
C16 .01
C28 .01
U14
U6
P35
12PIN

SCHEMATIC DIAGRAM



U17
HC138
U21
LS244
U22
LS244
U19
LS244
U20
LS244
RS3
RS2
RS1
RS0
D7
D6
D5
D4
D3
D2
D1
D0
+5V
X-Y
CURSOR-MODE 3
CURSOR-MODE 2
CURSOR-MODE 1
CURSOR-MODE 0
1/T
T
V2
V1
CH2/INV
H-VARI
H-MAG
SWEEP 4
SWEEP 3
SWEEP 2
SWEEP 1
SWEEP 0
V.MODE 3
V.MODE 2
V.MODE 1
V.MODE 0
ADD
CHOP
ALT
CH2
CH2/PROBE
CH1/PROBE
CH2/VARI
CH1/VARI
CH2/ATT3
CH2/ATT2
CH2/ATT1
CH2/ATT0
CH1/ATT3
CH1/ATT2
CH1/ATT1
CH1/ATT0
C71
.01X12
P33 12PIN
C70
.01X5
P15 5PIN
P16 13PIN
C72
.01X13
D6
MA700
R4
47K
U8
TM5020
TROLLER
ROD
CONT
DA0
DA1
DA2
DA3
DA4
DA5
DA6
DA7
DA8
DA9
U10
LM311
+10V
-10V
C31
.01
R5
10K
R6
1K
C6
330P
R7
100K
C26
.01
C25
22 16V
VREF+
VREF-
COMP
R8 10KF
R9 10K
C7
68P
-12V
R10 620F
R11 620F
U9 AM6012DC
R35
5.6
R12
9.1KF
R13
1.8KF
U11
NJM4558D
C20
.01
C33 .01
R15
1K
R16
330
Q1
2SC2785 (F)
C19
22
16V
C18
.01
R14
4.7KF
R17 4.7KF
C38
.01
C37
22
16V
R18
1K
Q2
2SA1175 (F)
R19
330
+1.25V
-1.25V
U14 4051B
VDD
VSS
VEE
INH
C34
.01
C35
.01
R21
6.2K
R22 7.5KF
R20
36KF
R25 6.2K
R23
7.5KF
R24
36KF
2, 4, 12, 15
C39
.01
C36
.01
ΔREF
Δ
P65 4PIN
1K
CURSOR VR
LEVX
VX0
VX1
VX2
VX3
AX0
AX1
AX2
AX3
HLDL
C16
.01
C28
.01
R26
47K
C8
.33
C9
.33
R27
47K
C10
.33
C11
.33
U6 4051B
1, 2, 4, 5
12, 15
SING
VSS
HLDF
SGA
ROUB
ROB
ROG
ROSP
C52 C51
.01 .01
0V
240mV/div
D3
MA700
R50
R51
R52
300
R/O-Y
R/O-X
C66
47P
C67
47P
C68
47P
P35
12PIN

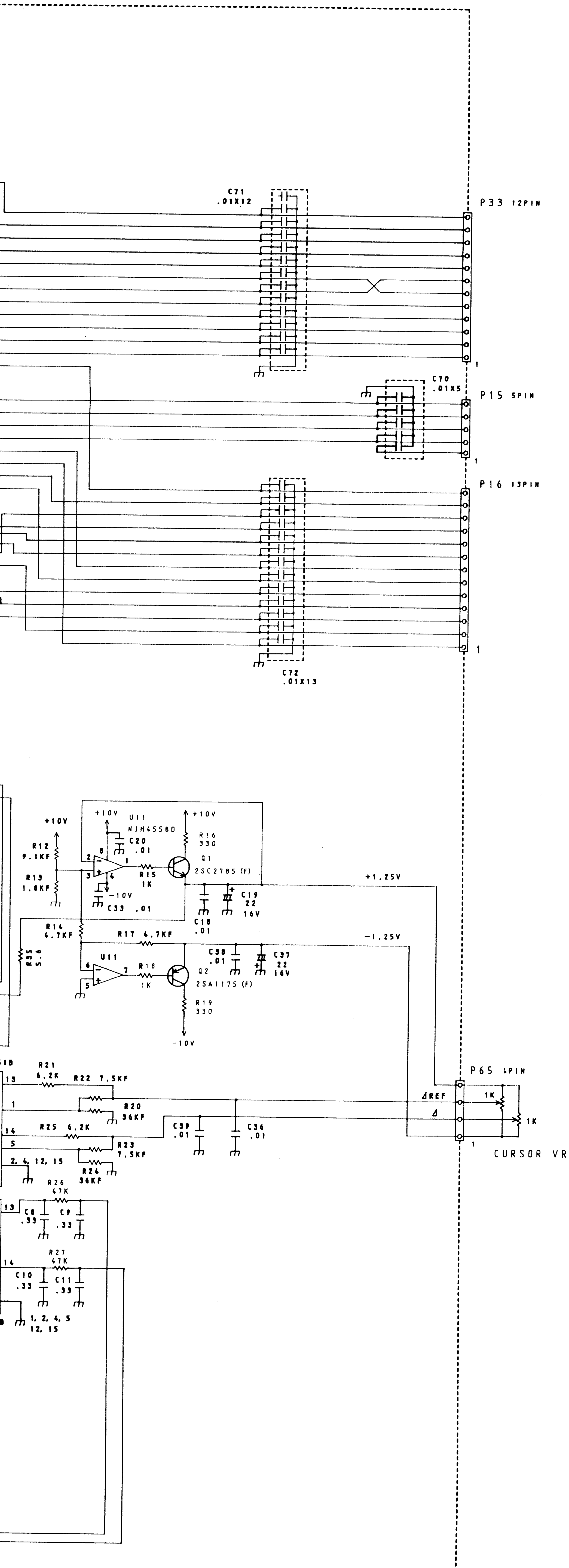
U1
U2
U3
U4, 5
U6, 14
U7
U8
U9
U10
U11
U13
U15
U16
U17
U18
U19, 20, 21, 22
U23
U24
U25
U26

Q1, 3
Q2

D1, 3, 4, 5, 6
D2

R101

AGRAM


C71
.01X12
P33 12PIN
1
C70
.01X5
P15 5PIN
1
P16 13PIN
1
C72
.01X13
+10V
R12
9.1KF
R13
1.8KF
+10V
U11
NJM4558D
C20
.01
C33 .01
-10V
R15
1K
+10V
R16
330
Q1
2SC2785 (F)
C19
22
16V
C18
.01
+1.25V
R14
4.7KF
R17 4.7KF
-1.25V
R35
5.6
U11
R18
1K
Q2
2SA1175 (F)
C38
.01
C37
22
16V
R19
330
-10V
R21
6.2K
R22 7.5KF
R20
36KF
R25 6.2K
R23
7.5KF
R24
36KF
2, 4, 12, 15
C39
.01
C36
.01
P65 4PIN
ΔREF
Δ
1K
1K
1
CURSOR VR
R26
47K
C8
.33
C9
.33
R27
47K
C10
.33
C11
.33
1, 2, 4, 5
12, 15

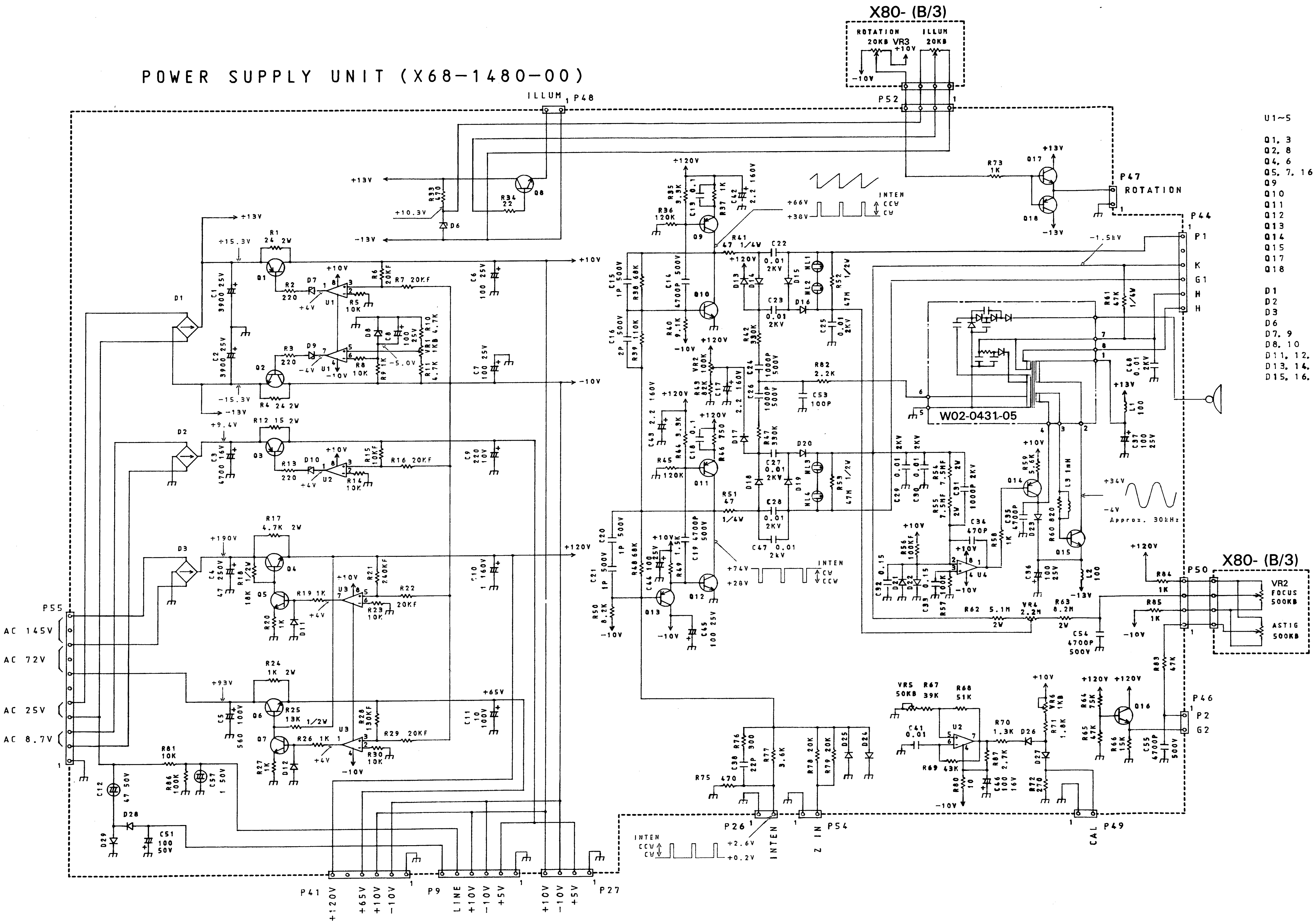
U1 : DAC0808LCN
U2 : HD74HC564P
U3 : SN74HC244N
U4, 5 : HD14052BP
U6, 14 : HD14051BP
U7 : MBM2764✱S
U8 : CTM5020
U9 : AM6012DC
U10 : LM311
U11 : NJM4558D
U13 : TL072CP
U15 : HD74HC10P
U16 : SN74LS04N
U17 : HD74HC138P
U18 : HD74HC373P
U19, 20, 21, 22 : HD74LS244P
U23 : CTM5030
U24 : MSM6242RS
U25 : PST518B
U26 : TA79L012P

Q1, 3 : 2SC2785 (F)
Q2 : 2SA1175 (F)

D1, 3, 4, 5, 6 : MA700
D2 : 1SS132

R101 : CR NETWORK

SCHEMATIC DIAGRAM


POWER SUPPLY UNIT (X68-1480-00)
X80- (B/3)
ROTATION 20KB VR3
ILLUM 20KB
+10V
-10V
ILLUM P48
P52
P47 ROTATION
P44
P1
K
G1
H
H
W02-0431-05
P50
X80- (B/3)
VR2 FOCUS 500KB
ASTIG 500KB
P46
P2
G2
P55
AC 145V
AC 72V
AC 25V
AC 8.7V
P41
+120V
+65V
+10V
-10V
P9
LINE
+10V
-10V
+5V
P27
+10V
-10V
+5V
P26
INTEN
P54
Z IN
P49
CAL
INTEN CCW CW
+2.6V
+0.2V
+66V
+38V
INTEN CCW CW
+74V
+28V
INTEN CW CCW
+34V
-4V
Approx. 30kHz
+13V
-13V
+10V
-10V
+120V
-1.5kV

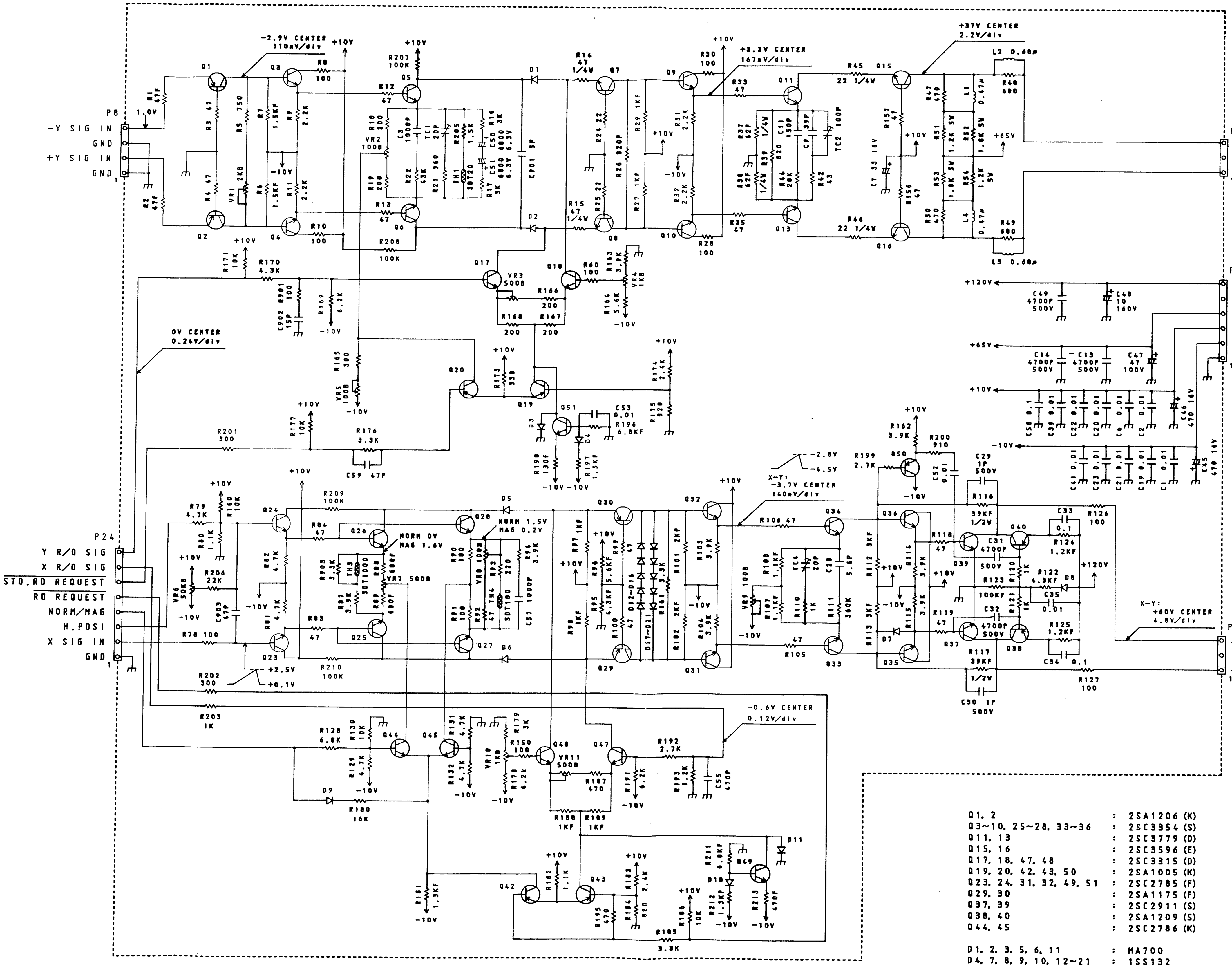
U1~5 : NJM4558D

Q1, 3 : 2SB1133 (S)
Q2, 8 : 2SD1666 (S)
Q4, 6 : 2SC3749 (N)
Q5, 7, 16 : 2SC2271 (D)
Q9 : 2SA1208 (S)
Q10 : 2SC2910 (S)
Q11 : 2SA1210 (S)
Q12 : 2SC2912 (S)
Q13 : 2SA1005 (K)
Q14 : 2SA1175 (F)
Q15 : 2SD613 (E)
Q17 : 2SC1384 (R)
Q18 : 2SA684 (R)

D1 : S4VB40F1
D2 : S2VB40F1
D3 : S1VB40
D6 : MT724JC
D7, 9 : MTZ10JC
D8, 10 : MTZ5.1JB
D11, 12, 21~29 : 1SS132
D13, 14, 17, 18 : 1SS83
D15, 16, 19, 20 : 1SR35-200

SCHEMATIC DIAGRAM

FINAL UNIT (X80-1090-00)

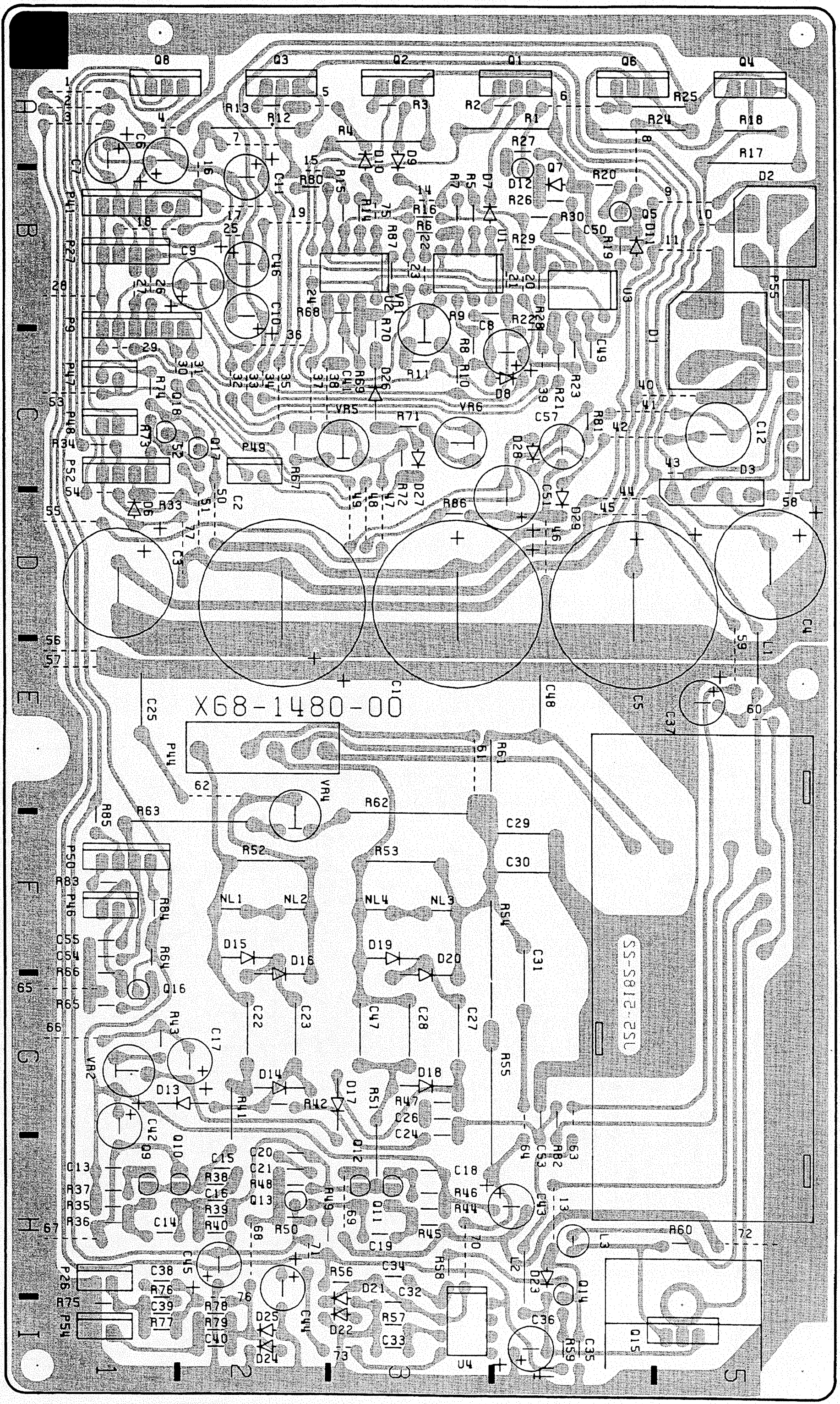

P8
-Y SIG IN
GND
+Y SIG IN
GND
P42
-Y
+Y
P41
+120V
+65V
+10V
-10V
GND
P24
Y R/D SIG
X R/D SIG
STO.RD REQUEST
RD REQUEST
NORM/MAG
H.POSI
X SIG IN
GND
P43
+X
-X
-2.9V CENTER 110mV/div
+3.3V CENTER 167mV/div
+37V CENTER 2.2V/div
0V CENTER 0.24V/div
X-Y: -3.7V CENTER 140mV/div
X-Y: +60V CENTER 4.8V/div
-0.6V CENTER 0.12V/div
NORM 0V MAG 1.6V
NORM 1.5V MAG 0.2V

Q1, 2 : 2SA1206 (K)
Q3~10, 25~28, 33~36 : 2SC3354 (S)
Q11, 13 : 2SC3779 (D)
Q15, 16 : 2SC3596 (E)
Q17, 18, 47, 48 : 2SC3315 (D)
Q19, 20, 42, 43, 50 : 2SA1005 (K)
Q23, 24, 31, 32, 49, 51 : 2SC2785 (F)
Q29, 30 : 2SA1175 (F)
Q37, 39 : 2SC2911 (S)
Q38, 40 : 2SA1209 (S)
Q44, 45 : 2SC2786 (K)

D1, 2, 3, 5, 6, 11 : MA700
D4, 7, 8, 9, 10, 12~21 : 1SS132

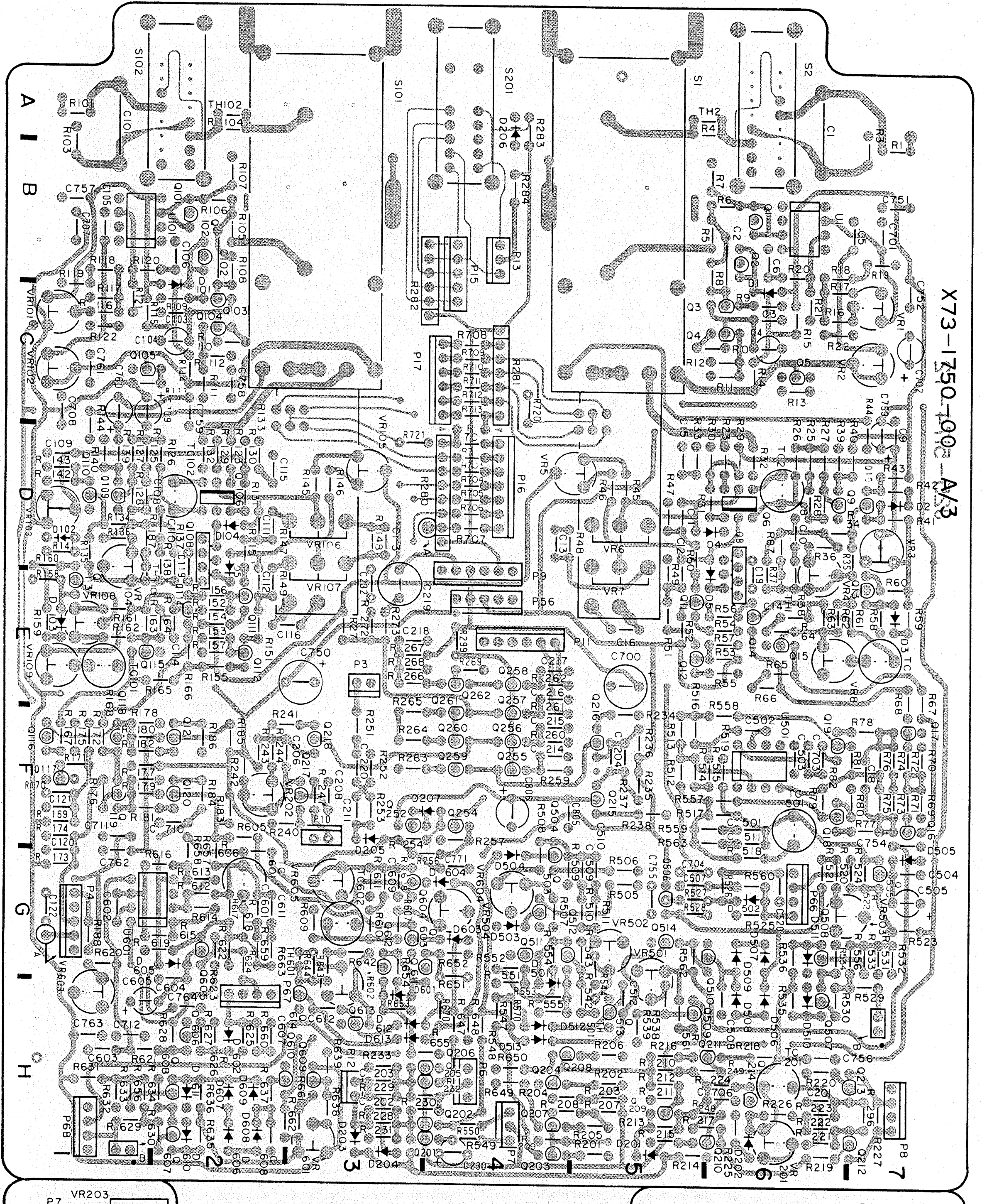
P.C. BOARD

POWER SUPPLY UNIT (X68-1480-00)


X68-1480-00
Q8
Q3
Q2
Q1
Q6
Q4
A
B
C
D
E
F
G
H
I
1
2
3
4
5
R13
R12
R4
R3
R2
R1
R25
R24
R18
R17
R27
R20
R26
R30
R29
R80
R15
R14
R87
R16
R6
R5
R7
R68
R70
R69
R9
R8
R10
R11
R22
R28
R21
R23
R19
R71
R72
R73
R74
R34
R33
R67
R86
R81
R63
R62
R85
R83
R84
R64
R66
R65
R43
R52
R53
R54
R55
R41
R42
R51
R47
R37
R35
R36
R38
R39
R40
R48
R49
R50
R46
R44
R45
R56
R57
R58
R59
R60
R61
R76
R75
R77
R78
R79
R82
Q5
Q7
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
D1
D2
D3
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
D19
D20
D21
D22
D23
D24
D25
D26
D27
D28
D29
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
C30
C31
C32
C33
C34
C35
C36
C37
C38
C39
C40
C41
C42
C43
C44
C45
C46
C47
C48
C49
C50
C51
C53
C54
C55
C57
VR2
VR4
VR5
VR6
U1
U3
U4
L1
L2
L3
NL1
NL2
NL3
NL4
P41
P27
P9
P47
P48
P52
P49
P55
P44
P50
P46
P26
P54
1S2-2185-SS

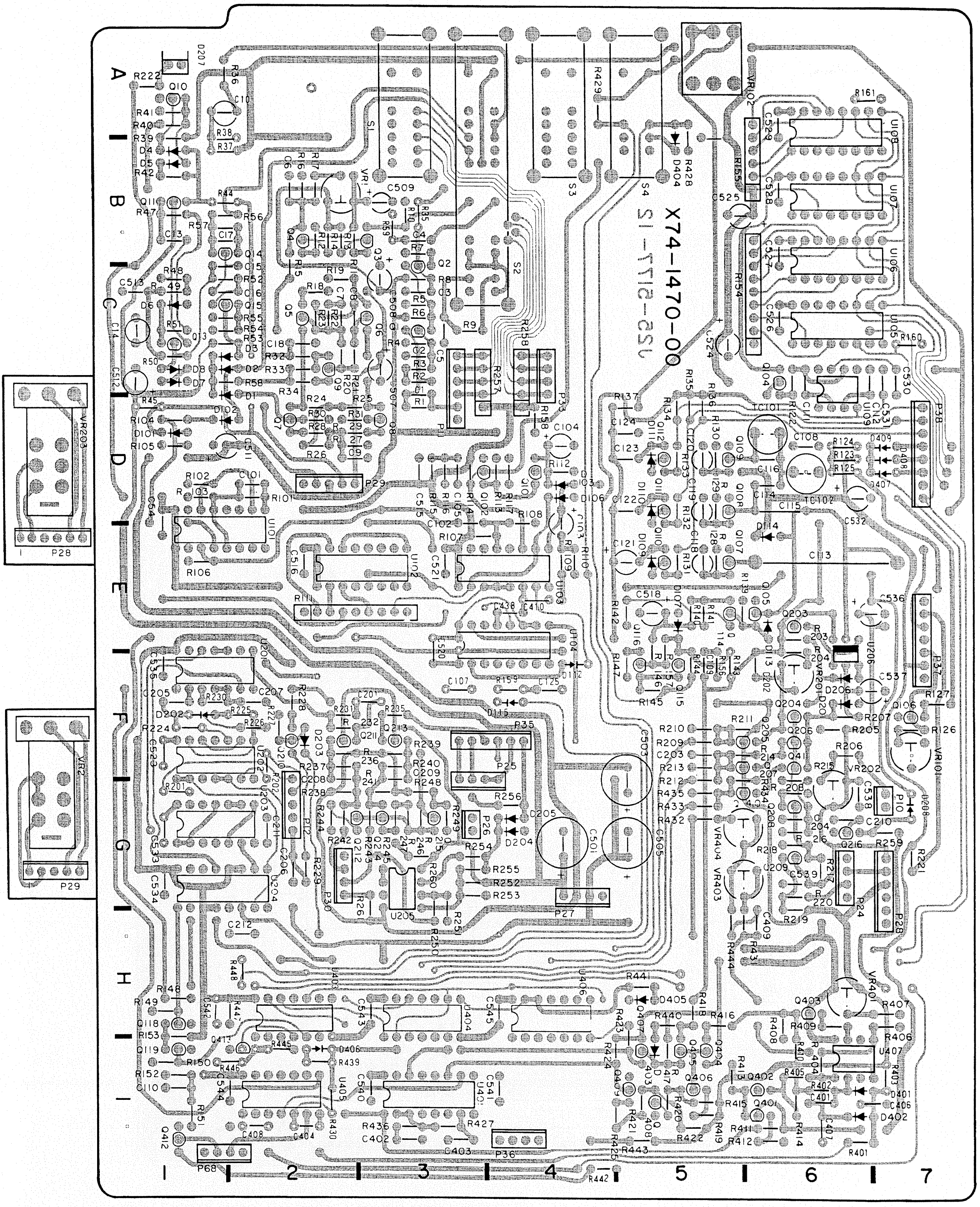
P.C. BOARD

V.PRE UNIT (X73-1750-00)


X73-1750-00 A/3
X73-B/3
X73-C/3
A
B
C
D
E
F
G
H
1
2
3
4
5
6
7

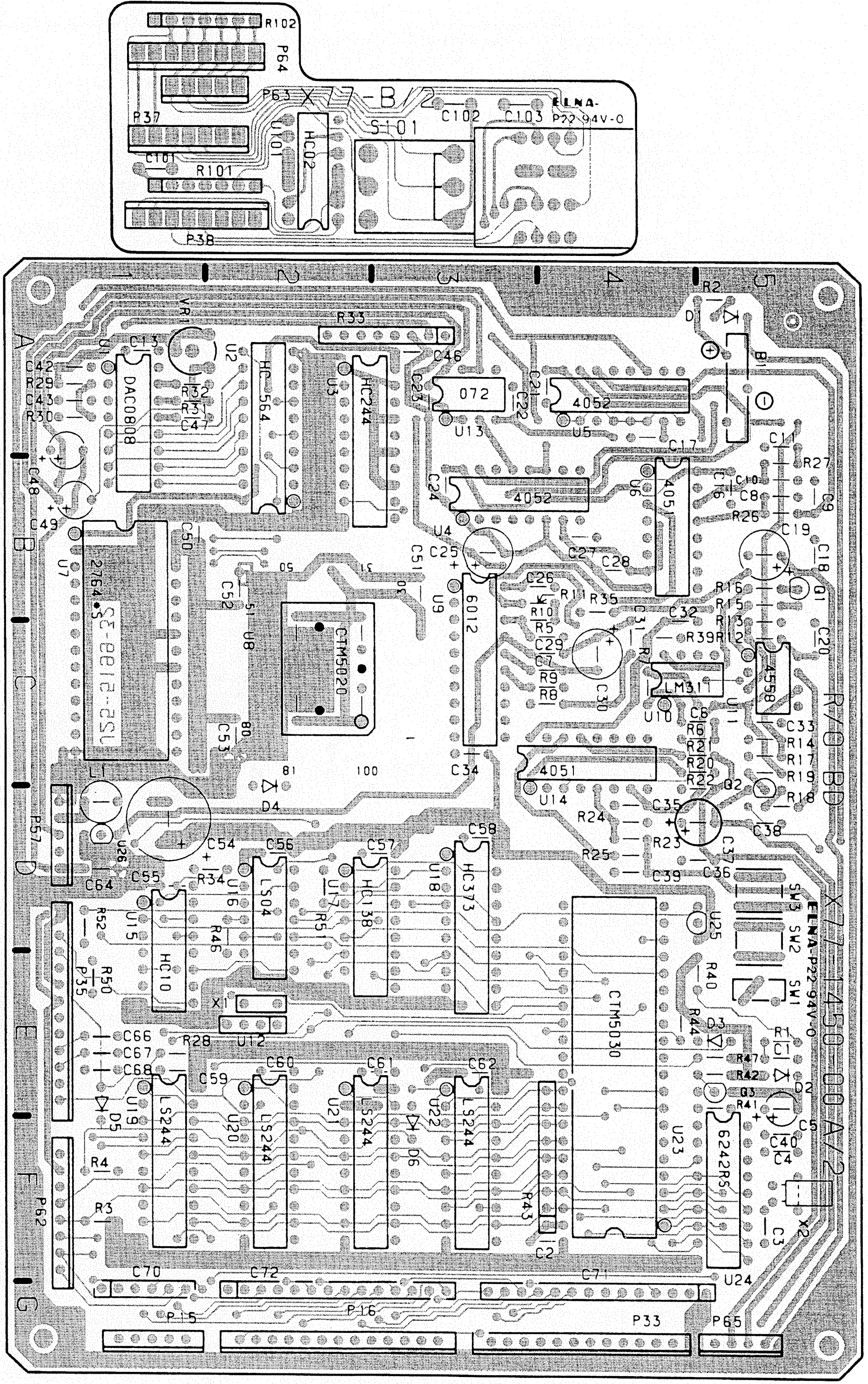
P.C. BOARD

SWEEP UNIT (X74-1470-00)


X74-1470-00
A
B
C
D
E
F
G
H
I
1
2
3
4
5
6
7
P28
P29
VR203
VR2
VR101
VR102
VR201
VR202
VR401
VR403
VR404
S1
S2
S3
S4
U101
U102
U103
U104
U105
U106
U107
U108
U109
U201
U202
U203
U204
U205
U206
U403
U404
U405
U406
U407
P25
P26
P27
P29
P33
P35
P36
P37
P38
P68
C501
C503
C505
C509

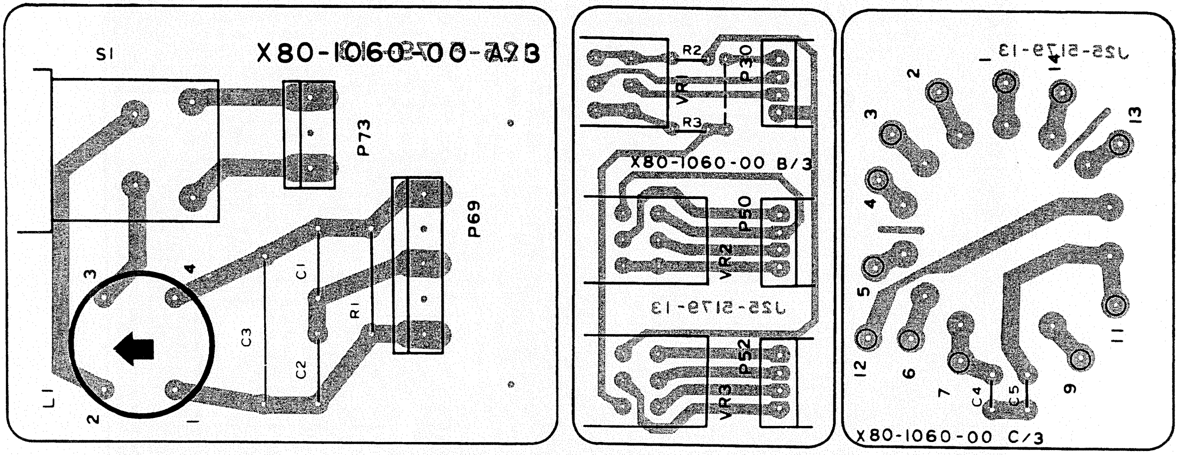
P.C. BOARD

R/O UNIT (X77-1450-00)


R102
P64
P63
X77-B/2
ELNA-P22 94V-0
P37
C101
U101
HC02
S101
C102
C103
R101
P38
1
2
3
4
5
A
B
C
D
E
F
G
R2
D1
VR1
R33
U1
C13
U2
C42
R29
C43
R30
DAC0808
R32
R31
C47
HC564
U3
HC244
C46
C23
072
C22
C21
4052
U13
U5
B1
C48
C11
R27
C17
C49
U7
C50
2764
C24
4052
U6
4051
C16
C10
C8
R26
C9
C19
C18
U4
C25
C51
C27
C28
C52
U8
CTM5020
U9
6012
C26
R11
R35
R10
R5
C29
C7
R9
R8
C31
C32
R39
R16
R15
R13
R12
C30
Q1
C20
R7
LM311
U10
U11
4558
C6
R6
R21
R20
R22
C33
R14
R17
R19
R18
R/O BD
C53
L1
D4
C34
4051
U14
Q2
C35
R24
R23
C38
P57
U26
C54
C56
C57
C58
C55
C64
R34
U16
LS04
U17
HC138
R51
U18
HC373
R25
C37
C39
C36
SW3
SW2
SW1
U25
R52
U15
HC10
R46
R50
P35
X1
R40
CTM5030
R44
D3
X77-1450-00 A/2
ELNA-P22-94V-0
R1
C1
C66
R28
U12
C67
C68
C60
C61
C62
C59
R47
R42
D2
Q3
R41
LS244
U19
D5
U20
LS244
U21
LS244
U22
D6
LS244
U23
6242RS
C40
C5
C4
R4
R43
X2
P62
R3
C3
C2
C70
C72
C71
U24
P15
P16
P33
P65

P.C. BOARD

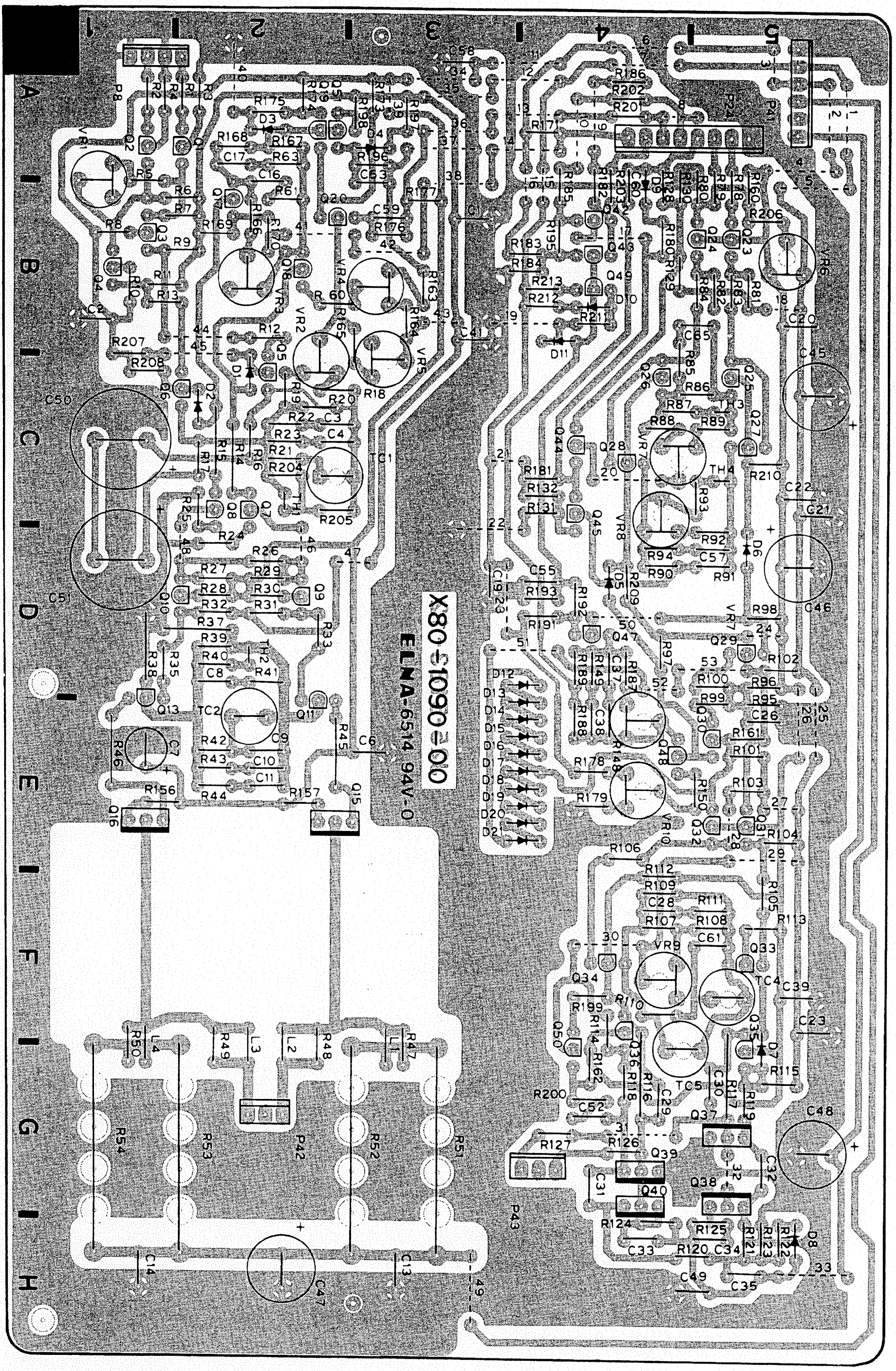
LINE FILTER UNIT (X80-1060-00)



S1
X80-1060-00 A/3
P73
P69
C1
C2
C3
R1
L1
1
2
3
4
R2
R3
VR1
P30
X80-1060-00 B/3
P50
VR2
J25-5179-13
P52
VR3
J25-5179-13
1
2
3
4
5
6
7
9
11
12
13
14
C4
C5
X80-1060-00 C/3

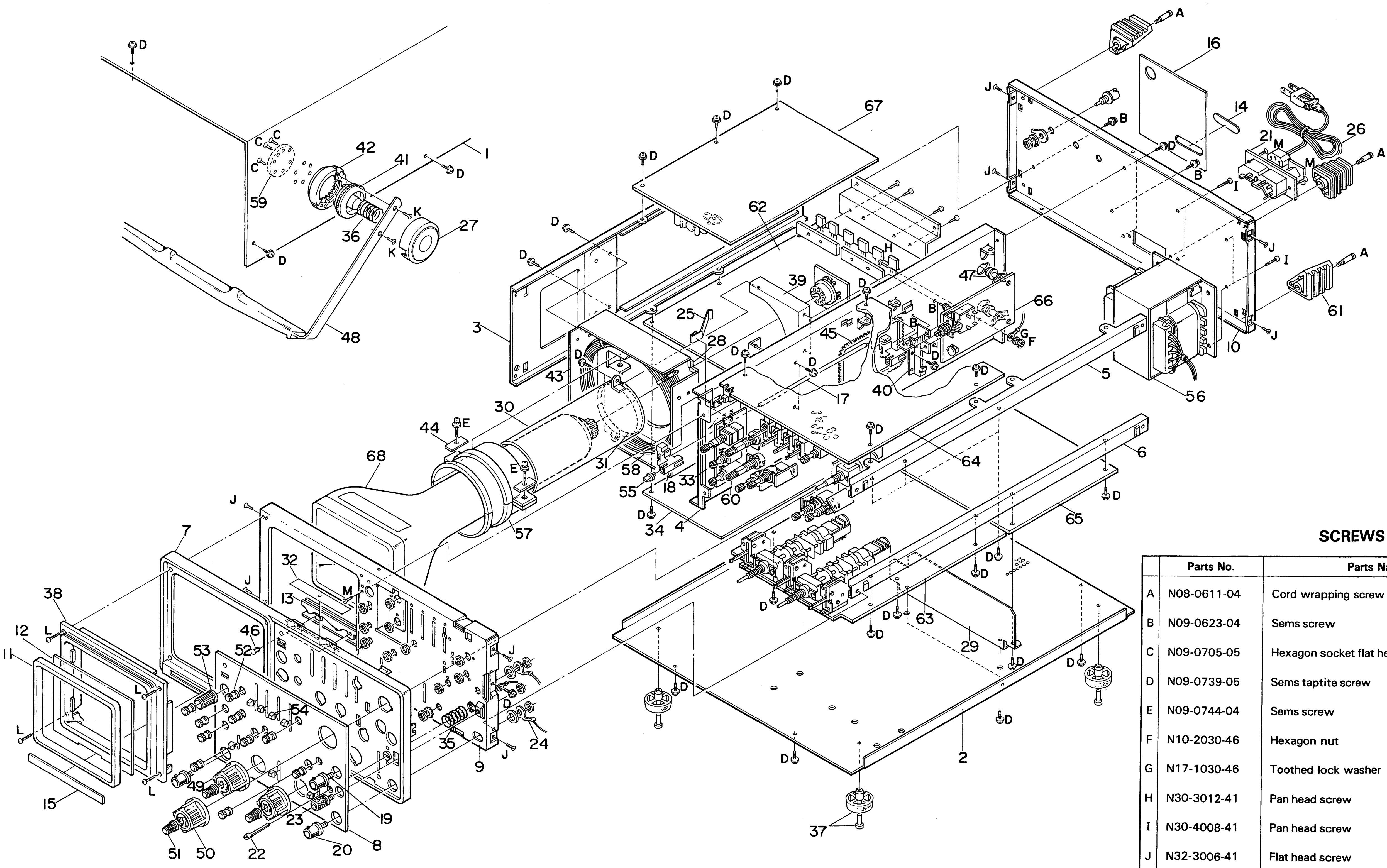
P.C. BOARD

FINAL UNIT (X80-1090-00)

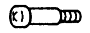
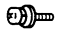


1
2
3
4
5
A
B
C
D
E
F
G
H
X80-1090-00
ELNA-6514 94V-0
P41
P42
P43
VR1
VR2
VR3
VR4
VR5
VR6
VR7
VR8
VR9
VR10
TC1
TC2
TC4
TC5
TH1
TH2
TH3
TH4
C45
C46
C47
C48
C50
C51
L1
L2
L3
L4
Q15
Q16

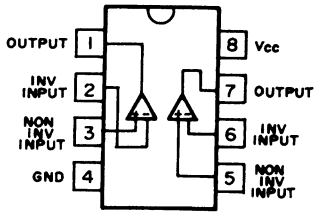
DISASSEMBLY


D
C
C
C
42
41
I
D
59
K
27
36
K
D
48
D
D
D
67
62
D
3
39
25
28
D
43
47
D
B
B
66
G
F
45
D
D
17
40
30
44
E
68
E
31
58
33
55
18
60
D
34
4
64
D
5
6
D
65
57
J
7
32
38
J
M
13
12
L
46
53
52
11
L
54
L
35
9
J
D
24
15
49
23
19
L
51
50
22
20
8
63
29
D
2
37
A
16
J
B
14
21
M
26
A
D
B
J
M
I
J
I
A
61
10
J
56
H

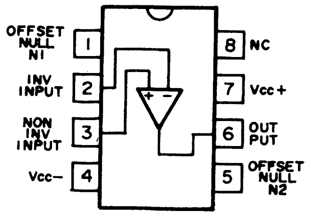
SCREWS

	Parts No.	Parts Name		Figure
A	N08-0611-04	Cord wrapping screw		
B	N09-0623-04	Sems screw	(M3 × 8)	
C	N09-0705-05	Hexagon socket flat head screw	(M4 × 8)	
D	N09-0739-05	Sems taptite screw	(M3 × 8)	
E	N09-0744-04	Sems screw	(M3 × 12)	
F	N10-2030-46	Hexagon nut		
G	N17-1030-46	Toothed lock washer		
H	N30-3012-41	Pan head screw	(M3 × 12)	
I	N30-4008-41	Pan head screw	(M4 × 8)	
J	N32-3006-41	Flat head screw	(M3 × 6)	
K	N32-3008-41	Flat head screw	(M3 × 8)	
L	N34-3012-41	Truss head screw	(M3 × 12)	
M	N88-3008-41	Flat head taptite screw	(M3 × 8)	

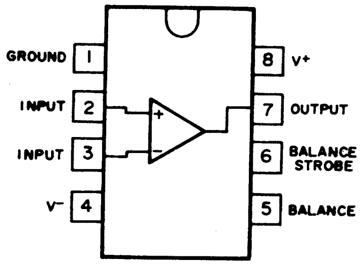
SEMICONDUCTORS


1 OUTPUT
2 INV INPUT
3 NON INV INPUT
4 GND
8 Vcc
7 OUTPUT
6 INV INPUT
5 NON INV INPUT

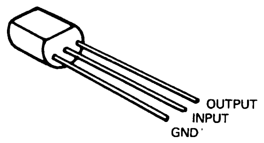
NJM4558D
TL072CP


1 OFFSET NULL N1
2 INV INPUT
3 NON INV INPUT
4 Vcc−
8 NC
7 Vcc+
6 OUT PUT
5 OFFSET NULL N2

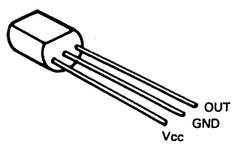
LF411CN
TL071CP


1 GROUND
2 INPUT
3 INPUT
4 V−
8 V+
7 OUTPUT
6 BALANCE STROBE
5 BALANCE

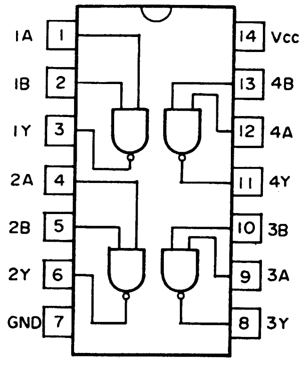
LM311N


OUTPUT
INPUT
GND

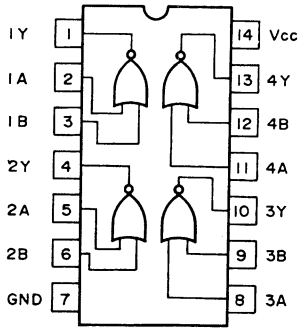
TA79L012P



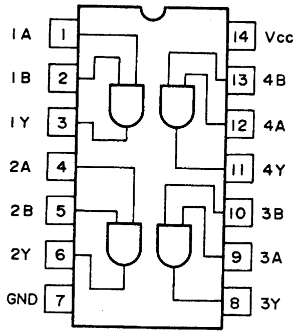
PST518B


1 1A
2 1B
3 1Y
4 2A
5 2B
6 2Y
7 GND
14 Vcc
13 4B
12 4A
11 4Y
10 3B
9 3A
8 3Y

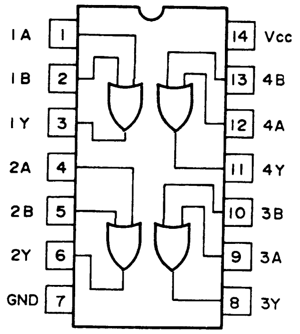
HD74HC00P
SN74ALS00AN


1 1Y
2 1A
3 1B
4 2Y
5 2A
6 2B
7 GND
14 Vcc
13 4Y
12 4B
11 4A
10 3Y
9 3B
8 3A

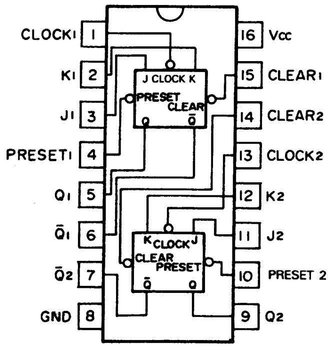
HD74HC02P


1 1A
2 1B
3 1Y
4 2A
5 2B
6 2Y
7 GND
14 Vcc
13 4B
12 4A
11 4Y
10 3B
9 3A
8 3Y

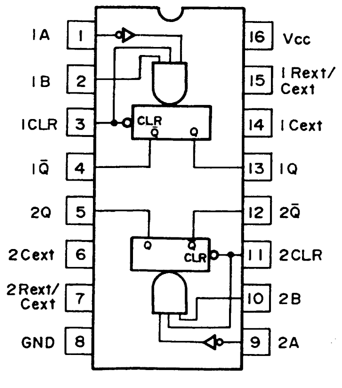
HD74HC08P


1 1A
2 1B
3 1Y
4 2A
5 2B
6 2Y
7 GND
14 Vcc
13 4B
12 4A
11 4Y
10 3B
9 3A
8 3Y

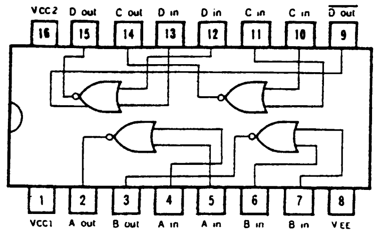
HD74HC32P


1 CLOCK1
2 K1
3 J1
4 PRESET1
5 Q1
6 Q̄1
7 Q̄2
8 GND
16 Vcc
15 CLEAR1
14 CLEAR2
13 CLOCK2
12 K2
11 J2
10 PRESET 2
9 Q2
J CLOCK K
PRESET
CLEAR
Q
Q̄
K CLOCK J
CLEAR
PRESET
Q̄
Q

HD74HC112P


1 1A
2 1B
3 1CLR
4 1Q̄
5 2Q
6 2Cext
7 2Rext/Cext
8 GND
16 Vcc
15 1Rext/Cext
14 1Cext
13 1Q
12 2Q̄
11 2CLR
10 2B
9 2A
CLR
Q̄
Q
Q
Q̄
CLR

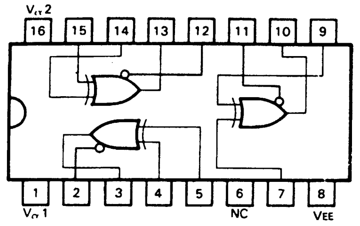
TC74HC123P


VCC2 16
D out 15
C out 14
D in 13
D in 12
C in 11
C in 10
D̄ out 9
VCC1 1
A out 2
B out 3
A in 4
A in 5
B in 6
B in 7
VEE 8

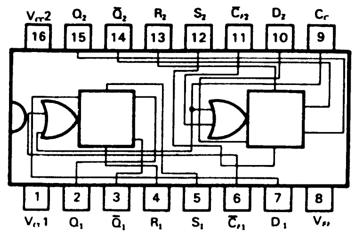
MC10102L

KENW-03283 / DRUCK 14

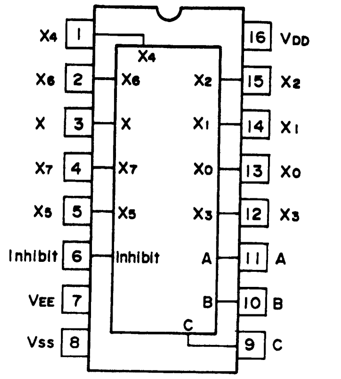
SEMICONDUCTORS


VCC2 16
15
14
13
12
11
10
9
VCC1 1
2
3
4
5
NC 6
7
VEE 8

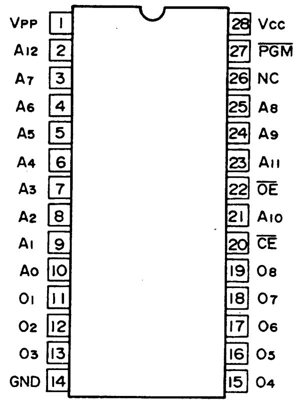
MC10107L


VCC2 16
Q2 15
Q̄2 14
R2 13
S2 12
C̄E2 11
D2 10
CC 9
VCC1 1
Q1 2
Q̄1 3
R1 4
S1 5
C̄E1 6
D1 7
VEE 8

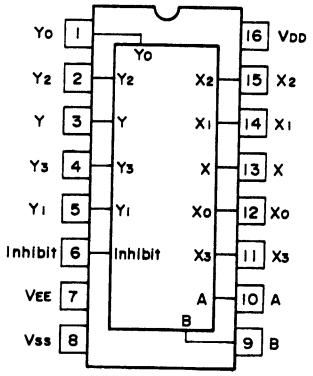
MC10H131L


X4 1
X6 2
X 3
X7 4
X5 5
Inhibit 6
VEE 7
Vss 8
16 VDD
15 X2
14 X1
13 X0
12 X3
11 A
10 B
9 C
X4
X6
X
X7
X5
Inhibit
X2
X1
X0
X3
A
B
C

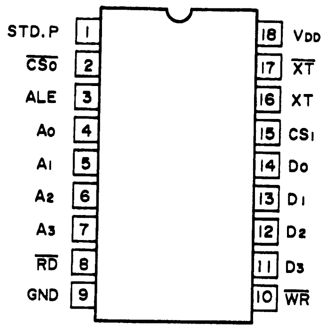
HD14051BP
MC14051BCP


VPP 1
A12 2
A7 3
A6 4
A5 5
A4 6
A3 7
A2 8
A1 9
A0 10
O1 11
O2 12
O3 13
GND 14
28 Vcc
27 P̄G̅M̅
26 NC
25 A8
24 A9
23 A11
22 ŌĒ
21 A10
20 C̄Ē
19 O8
18 O7
17 O6
16 O5
15 O4

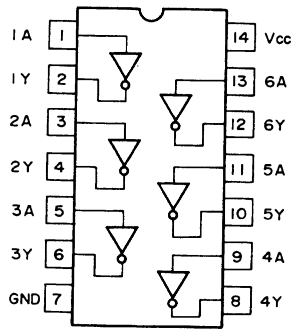
MBM2764*S


Y0 1
Y2 2
Y 3
Y3 4
Y1 5
Inhibit 6
VEE 7
Vss 8
16 VDD
15 X2
14 X1
13 X
12 X0
11 X3
10 A
9 B
Y0
Y2
Y
Y3
Y1
Inhibit
X2
X1
X
X0
X3
A
B

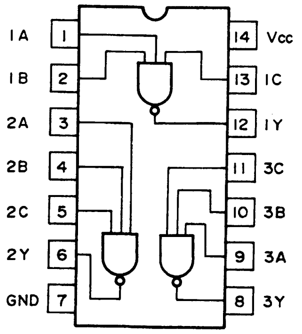
HD14052BP


STD.P 1
C̄S̄0 2
ALE 3
A0 4
A1 5
A2 6
A3 7
R̄D̄ 8
GND 9
18 VDD
17 X̄T̄
16 XT
15 CS1
14 D0
13 D1
12 D2
11 D3
10 W̄R̄

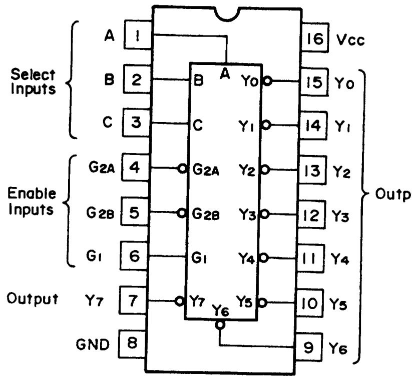
MSM6242BRS


1A 1
1Y 2
2A 3
2Y 4
3A 5
3Y 6
GND 7
14 Vcc
13 6A
12 6Y
11 5A
10 5Y
9 4A
8 4Y

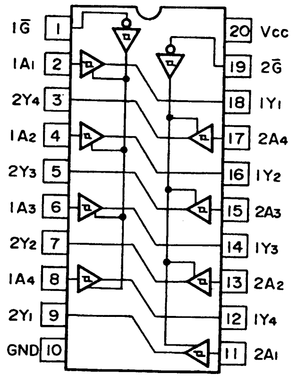
SN74LS04N


1A 1
1B 2
2A 3
2B 4
2C 5
2Y 6
GND 7
14 Vcc
13 1C
12 1Y
11 3C
10 3B
9 3A
8 3Y

HD74HC10P

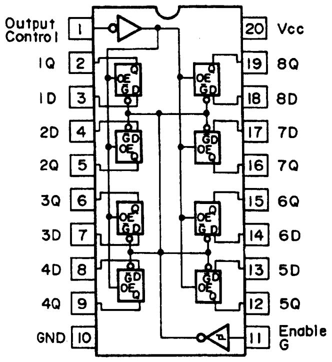

Select Inputs
A 1
B 2
C 3
Enable Inputs
G2A 4
G2B 5
G1 6
Output
Y7 7
GND 8
16 Vcc
15 Y0
14 Y1
13 Y2
12 Y3
11 Y4
10 Y5
9 Y6
Outputs
A
B
C
G2A
G2B
G1
Y7
Y0
Y1
Y2
Y3
Y4
Y5
Y6

HD74HC138P

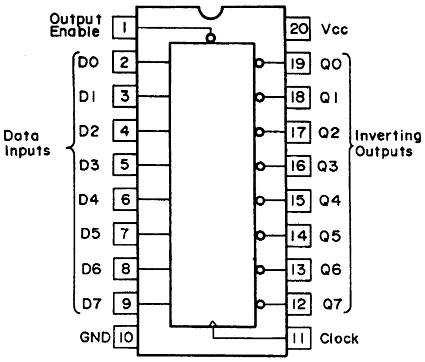

1Ḡ 1
1A1 2
2Y4 3
1A2 4
2Y3 5
1A3 6
2Y2 7
1A4 8
2Y1 9
GND 10
20 Vcc
19 2Ḡ
18 1Y1
17 2A4
16 1Y2
15 2A3
14 1Y3
13 2A2
12 1Y4
11 2A1

HD74HC244P
SN74LS244N

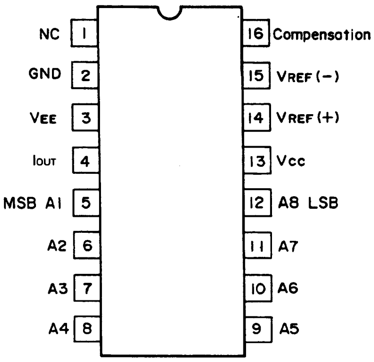
SEMICONDUCTORS


Output Control
1
1Q
2
1D
3
2D
4
2Q
5
3Q
6
3D
7
4D
8
4Q
9
GND
10
20
Vcc
19
8Q
18
8D
17
7D
16
7Q
15
6Q
14
6D
13
5D
12
5Q
11
Enable G
OE
GD

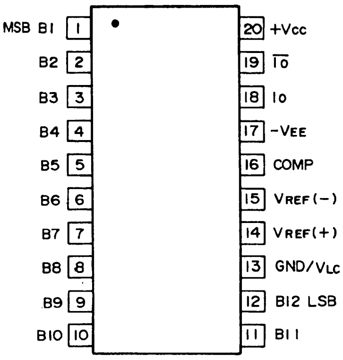
HD74HC373P


Output Enable
1
Data Inputs
D0
2
D1
3
D2
4
D3
5
D4
6
D5
7
D6
8
D7
9
GND
10
20
Vcc
19
Q0
18
Q1
17
Q2
16
Q3
15
Q4
14
Q5
13
Q6
12
Q7
11
Clock
Inverting Outputs

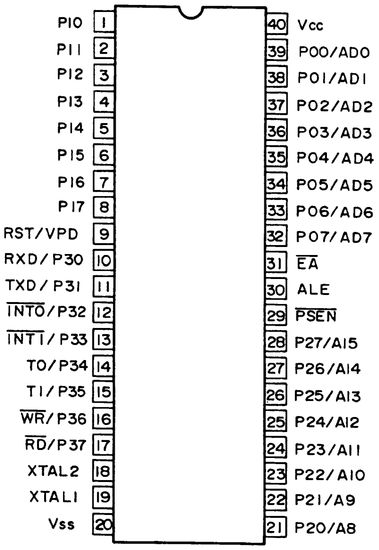
HD74HC564P


NC
1
GND
2
VEE
3
IOUT
4
MSB A1
5
A2
6
A3
7
A4
8
16
Compensation
15
VREF (−)
14
VREF (+)
13
Vcc
12
A8 LSB
11
A7
10
A6
9
A5

DAC0808LCN


MSB B1
1
B2
2
B3
3
B4
4
B5
5
B6
6
B7
7
B8
8
B9
9
B10
10
20
+Vcc
19
$\overline{\text{Io}}$
18
Io
17
−VEE
16
COMP
15
VREF (−)
14
VREF (+)
13
GND/VLC
12
B12 LSB
11
B11

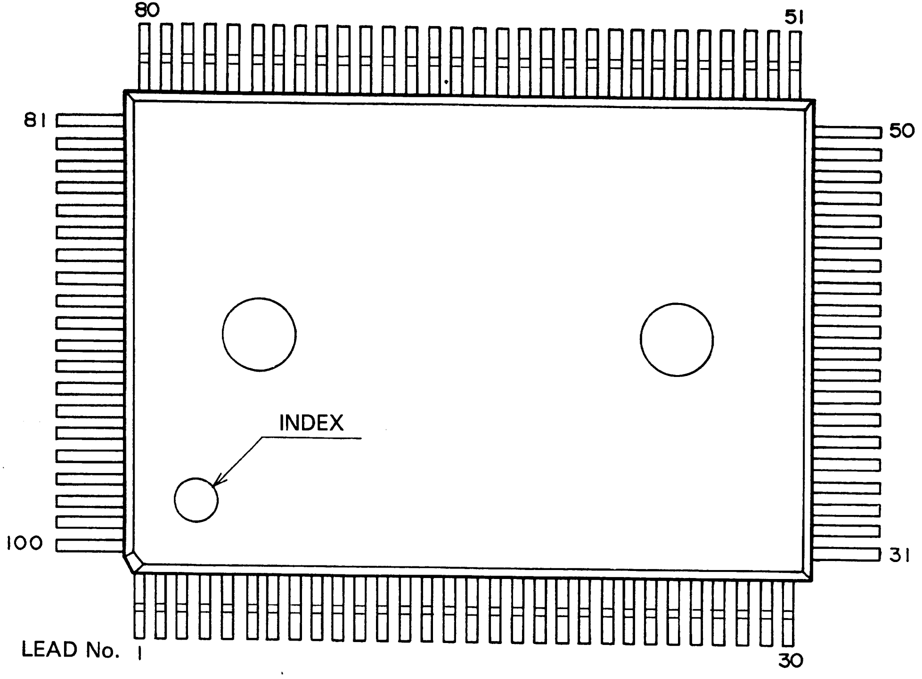
AM6012DC


P10
1
P11
2
P12
3
P13
4
P14
5
P15
6
P16
7
P17
8
RST/VPD
9
RXD/P30
10
TXD/P31
11
$\overline{\text{INT0}}$/P32
12
$\overline{\text{INT1}}$/P33
13
T0/P34
14
T1/P35
15
$\overline{\text{WR}}$/P36
16
$\overline{\text{RD}}$/P37
17
XTAL2
18
XTAL1
19
Vss
20
40
Vcc
39
P00/AD0
38
P01/AD1
37
P02/AD2
36
P03/AD3
35
P04/AD4
34
P05/AD5
33
P06/AD6
32
P07/AD7
31
$\overline{\text{EA}}$
30
ALE
29
$\overline{\text{PSEN}}$
28
P27/A15
27
P26/A14
26
P25/A13
25
P24/A12
24
P23/A11
23
P22/A10
22
P21/A9
21
P20/A8

CTM5030

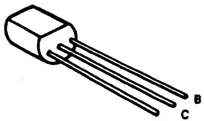
SEMICONDUCTORS

CTM5020

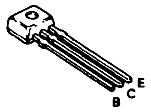


Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	CONT	26	TSD0	51	GETD	76	DD3
2	A13	27	TSD1	52	CA0	77	SING
3	VDD	28	VDD	53	VDD	78	VDD
4	A14	29	TSD2	54	CA4	79	R10M
5	A15	30	AX2	55	CA3	80	10M
6	INT0	31	AX1	56	CA2	81	HLDF
7	VX3	32	AX0	57	CA1	82	SGA
8	VX2	33	AX3	58	CD3	83	ROSP
9	VX1	34	HS2	59	CD2	84	ROD
10	VX0	35	HS1	60	CD4	85	HLDL
11	DA0	36	TDIO	61	CD1	86	ROUB
12	DA1	37	TWE	62	CD5	87	ROB
13	DA2	38	TCK1	63	DC4	88	ROQ
14	DA3	39	TST1	64	CD7	89	ROED
15	VSS	40	VSS	65	VSS	90	VSS
16	DA4	41	TST2	66	DC3	91	D7
17	DA5	42	TADD	67	DC2	92	D5
18	DA6	43	TCK2	68	CD6	93	D3
19	DA7	44	VS2	69	DC1	94	D1
20	DA8	45	VS1	70	DC0	95	ALE
21	DA9	46	VA0	71	CD0	96	D6
22	ROR	47	VA4	72	DD7	97	D4
23	ROA	48	VA3	73	DD6	98	D2
24	LEVX	49	VA2	74	DD5	99	D0
25	TCL	50	VA1	75	DD4	100	WR

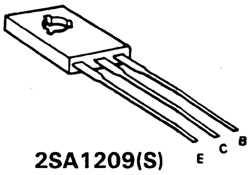
SEMICONDUCTORS



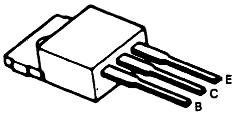
2SA684(R)
2SA1005(K)
2SA1208(S)
2SC1384(R)
2SC2271(D)
2SC2910(S)



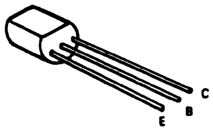
2SA1175(F)
2SC2785(F)
2SC2786(K)



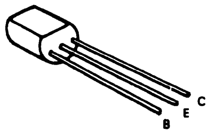
2SA1209(S)
2SA1210(S)
2SC2911(S)
2SC2912(S)
2SC3596(E)



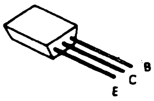
2SB1133(S)
2SC3749(N)
2SD613(E)
2SD1666(S)



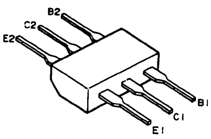
2SA1206(K)



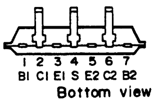
2SC2671(H)
2SC3779(D)



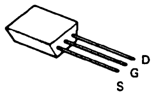
2SC3315(D)
2SC3354(S,T)


B2
C2
E2
B1
C1
E1

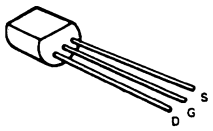
2SC4072


1 2 3 4 5 6 7
B1 C1 E1 S E2 C2 B2
Bottom view

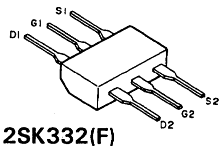
2SC3381(GR)



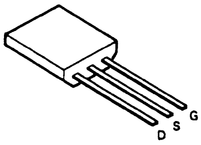
2SK404(F)



2SK117(Y)


S1
G1
D1
S2
G2
D2

2SK332(F)



2SK241(Y)